DIETARY HABITS AND NUTRITIONAL BASE OF NATIVE POPULATIONS OF THE NORTHWEST TERRITORIES

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Foreword

Basic to health is nutrition; and the nutrition of people who traditionally live by hunting is particularly vulnerable to cultural and social change.

The Science Advisory Board of the Northwest Territories has commissioned four previous reports which bear on the interrelationships between indigenous food resources, northern people and their traditions (1,2,3, and 4*). This present report, which deals more directly with the issues of diet and nutrition of northern indigenous people, is an important addition to this series. For this we turned to Otto Schaefer to bring together the extensive existing information — much of which is the product of his own research — on the health, and particularly the nutritional health of these people.

He has put together in his own inimitable style — which has happily survived the onslaught of well-meaning reviewers — not only a compendium of factual information but also his expert opinion which often ranges beyond the strict confines of nutritional science. In the process of preparing this paper he stimulated a valuable study, now separately published, on the "Availability, Cost and Nutritional Value of Imported Foods."

Dr. Jean M. Steckle, Schaefer's co-author, has been particularly concerned with that section of the report dealing with the practical problems of ensuring optimum nutrition at reasonable cost.

The Science Advisory Board is grateful to Dr. Schaefer for accepting this commission; his knowledge and experience gives the work its authority. The Board hopes that this compendium and Schaefer's opinions will be found useful by those who have an interest in the health of the people of the Northwest Territories.

J. A. Hildes M.D.
August 1980

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1.
Contribution to the Northwest Territories Population Studies 1961 - 1985
by:
Professor Louis-Edmond Hamelin

2.
Aquatic Resources of the Northwest Territories
by:
Dr. Peter J. McCart and
Mr. J. Den Beste

3.
The Present Status and Future Management of Arctic Marine Mammals in Canada
by:
Drs. Ralph A. Davis
Kerwin J. Finley and
W. John Richardson

4.
Management of Some Terrestrial Mammals in the Northwest Territories for Sustained Yields
by:
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Introduction

Dietary habits and the nutritional base of native populations in the N.W.T. underwent profound changes during the last two generations, which perhaps more than any other factors influence their health and socio-economic well-being. It is also a factor amenable to judicious management.

We shall therefore review in the following chapters not only facts known in regard to the nutritional base of native people in the N.W.T. in aboriginal and changes experienced in transitional times, and effects observed on their health, but also discuss availability and nutritional value of traditional local food resources as well as accessibility and cost of imported alternatives and recommend actions to improve optimal nutrition at reasonable cost from use of local and/or imported sources.

All native population groups in Northern Canada lived off hunting, fishing, and to a minor degree, food gathering in aboriginal times. The Inuit with few exceptions stayed north of the tree line using the resources of land, rivers and lakes of the tundra and most of them relied even more on the resources of the Arctic Sea. Conversely, the habitat of the Dene was mainly the boreal forest and taiga. They rarely ventured into the treeless tundra.

Although some groups of both Inuit (e.g., the "Barren Lands" or "Caribou Eskimos") and Dene (in particular the Chipewyan) shared their predominant reliance on migrating caribou herds, marked differences in nutrition habits as well as different acculturation histories warrant separate discussion of the main native population groups.

Dietary Habits and Nutritional Base of Aboriginal Diets in Transitional Times – Current Trends and Problems

THE INUIT

The Inuit are the most numerous native group in the Northwest Territories, estimated to number just under 15,000 in mid 1977/78. We should note that contrary to popular opinion, their present number does not exceed population size in pre-contact times when 15,000 to 18,000 Inuit are estimated to have lived in the area of the Northwest Territories. These figures do not support frequently advanced arguments downgrading importance and feasibility of placing greater reliance on exploitation of local food resources for the native population. In respect to total numbers, Inuit in the Northwest Territories have not yet outgrown the potential of their traditional nutrition base although that may be the case in the immediate vicinity of larger population centres.

It is even more important to realize that the aboriginal diet was derived almost exclusively from animal sources and consisted mainly of protein, very little carbohydrate and less fat than is generally assumed[25,36,39] although some early researchers reported higher fat intakes[34], especially during certain hunting seasons[8]. Protein was also the pre-eminent nutrient and supplied most of the caloric needs for Northern Indians as it did for the Inuit. Such a diet is wasteful of protein, especially when a relative deficiency of carbohydrates necessitates large scale transformation of aminoacids into glucose and glycogen. This process may explain the liver enlargement found in healthy Inuit 20-30 years ago[8,25,51], which has been noted to disappear on a mixed diet[25]. In addition to this relatively wasteful use of protein, the almost complete disappearance of dog teams which in former times consumed at least one third of the fish and meat taken, should allow the available native animal protein sources to supply the requirements for perhaps five or six times the number of people who used to subsist on these sources in aboriginal times. It is the contention in this paper that all native inhabitants (and perhaps most of the non-native inhabitants) of the Northwest Territories at the present time could be provided with protein from local sources without danger of depletion of that source if reasonable controls, systematic exploitation, distribution and marketing were effected. In fact, this could probably be achieved using only sea mammal protein which is now either wasted or underexploited, rather than continuing the excessive hunting pressure on the large land animals, particularly the caribou, but also including moose and bison. Practical recommendations in this regard will be discussed in a later section of this paper.

FOOD RESOURCES

The traditional food resources one associates most readily with the Inuit are those provided by the Arctic Sea; seals, walrus and whales. This was true for most but not all Inuit. There were some well-defined populations of Inuit who relied to a great extent on caribou hunting. The Nunatagmiut of the North Slope of Alaska are mentioned here sice the Inuit now residing in the Mackenzie Delta and the surrounding coast are mainly derived from them. Even more so the Inuit south of Coppermine and Bathurst Inlet and the Barren Lands or "Caribou Eskimos" in the interior of the Keewatin lived predominantly on caribou and fish. Some of these groups never ventured to the sea coast, while others migrated seasonally to the coast in spring for seal hunting.

Aside from pursuing sea mammals and caribou, many Inuit groups moved in early summer and again in the fall to the fish camps to exploit the seasonal migration of Arctic char, grayling, whitefish and other fish species. These were usually caught in fish weirs, tidal pools or at river falls and rapids.

Also in the nesting areas and along the flyways of ducks, geese, murres, sea gulls and other migratory birds, adult birds and especially eggs of ducks and sea gulls were taken as important seasonal foods.

For the purpose of putting into perspective some historical facts relating to food supply, I may digress a little here to comment on caribou hunting.

The Inland Eskimos exploited the more or less predictable seasonal migrations of the caribou by moving to strategically located points such as mountain passes or the defiles between chains of lakes where caribou could be taken with relative ease. Waiting patiently for the arrival of the migrating caribou herds at these strategic crossing points was a sensible behavior pattern in response to, and in tune with, needs and circumstances, increasing chances of survival for a maximum number of family groups as long as the large and plentiful caribou herds remained without depletion. In that situation, even if the caribou failed to appear at one usual crossing point, they would be taken by the groups awaiting at other crossing points, and food sharing would allow all groups to survive. This behavior pattern with greater priority given to food sharing than to food preservation was to a degree practiced by

all Inuit but was found most typically in the Inland or Caribou Eskimo.

This system was decried, and harshly criticized as "fatalistic" and "lazy" by non-understanding white officials and traders, when in the 1940's and 1950's the drastically depleted caribou herds failed to appear, not only at just one crossing but often in an entire region, and the people starved while persisting in their habits of waiting patiently in one spot and relying on sharing. A new and artificial situation had turned an appropriate social and ecological adaptation into a disastrous liability, as attested by the number of famine victims in those years in the Barren Lands of the Keewatin.

HOARDING AND PRESERVATION OF FISH AND MEAT

Notwithstanding the above, small scale preservation of game meat and particularly of fish was practiced in many areas of the Arctic. The caches were often above ground and covered with rocks. There were some places, particularly in the Western Arctic, where subterranean ice houses were used. In some areas the fall caches of Arctic char remained frozen and could last throughout most of the winter, serving often as the most reliable food staple. This fact may not be commonly realized nowadays.

The char caught in the fall and kept frozen was usually eaten raw-frozen, as was some meat, particularly caribou, and also to a lesser extent, seal. An old man in the Cumberland Sound area told me many years ago that the Inuit found that if they did not eat at least part of their meat and fish in the winter raw, in the spring they would have loose teeth and bleeding gums (Aksayuk, Pangnirtung 1956 — personal communication). This illustrates the fact that Inuit of the High and Central Arctic had a very limited supply of vitamin C and folate from land and sea flora, and consequently meat and fish were their principal sources but the amounts present there were too small to allow major losses by cooking. (See discussion on page 17 and Tables XII and XIII re vitamin C content of northern food.)

FOOD GATHERING

Although it is not well-appreciated today, the Inuit used whenever available, whatever vegetable matter was available on land and sea as berries, herbs, willow buds, some roots and predigested reindeer moss and other herbs from the stomachs of caribou, Arctic hare and ptarmigan. Seaweed was regularly collected by women and children even in midwinter in those areas in the Eastern Arctic where high tides exposed them.

The nutritional value of these practices is indicated in some detail in later sections of this paper.

OTHER METHODS OF FOOD PRESERVATION

Drying strips of caribou meat and drying split fish on drying racks or rocks was also used in many areas but was more prevalent in inland and southern regions than in the High Arctic.

SEASONAL VARIATIONS IN FOOD INTAKE

Despite these efforts at food preservation, the Inuit and also Northern Indians had to move with the seasons to fully exploit their various game resources. This caused considerable variation not only in the amount but also in the kinds of food intake. An example of marked variation of meat and fat intake depending on which seasonal resources were pursued, was documented by G. M. Brown[6], which I copy in Table I.

AVERAGE PER CAPITA CONSUMPTION OF NUTRIENTS BY INUIT

Notwithstanding the seasonal variation noted above, studies in Alaska[25,26], the Canadian Arctic[32,49,50] and Greenland[5,72] show consistently a relatively low total caloric and low fat intake on the average for the year, even if allowing for underestimates in surveys based on dietary recall data. Higher fat intakes were estimated by Draper[13] and Rodahl[47] for Alaska, Sinclair[60] for Canada, and Krogh[34] and Bang[2] for Greenland Eskimos. But these were mainly fats and oils from fish and sea mammals which are known to have a high proportion of polyunsaturated long-chain fatty acids[2]. Even caribou fat is more unsaturated than beef (21% v. 3%)[13].

A modifying effect of such different dietary fatty acid patterns on platelet aggregation and therefore thrombosis and other cardiovascular pathology was recently demonstrated in North West Greenlandic Eskimos[14].

Table II shows the 1964 per capita consumption of major nutrients in four Canadian Eskimo settlements[32], compared with the 1955 U.S.A. consumption as recorded in reference 12. At the time this study was done in the early and mid sixties the population of Holman Island in the Western Arctic and Pangnirtung in the Eastern Arctic was still predominantly living by hunting and fishing while Frobisher Bay was an urbanized settlement already showing a diminished average pro-

TABLE I

DAILY MEASURED FOOD INTAKES OF EIGHT MALE ESKIMOS IN SUMMER

	Lean Meat (g)	Blubber (g)	Bannock (g)	N Excret. g/24 hrs.	Calculated Prot. Catabol. g/24 hrs.
Walrus Meat Period					
Family 1	343	114	208	14.3	89
Average					
Family 2	365	333	0	14.6	91
Caribou Meat Period					
Family 2	904	35	209	22.4	140

N.B. Walrus meat period extends in the population examined by G. M. Brown from spring to early summer, while the caribou meat period extends from late summer into the fall season. Marked differences in fat, carbohydrate and protein intake appear to result not only from different seasonal hunting pursuit but also availability and use of trading goods (flour for bannock).

tein intake. The fat intake for all four settlements was estimated to be less than one half of that consumed by Americans in 1955. Slightly higher fat consumption was recorded in Alaskan natives in the late fifties, but 60% of this came from imported sources[10]. When re-examined more than a decade later Alaskan Eskimos had increased their fat intake to over 100 g/day or around 40% of their total caloric intake[11].

Table III compares data on the main nutrients and total caloric intake of Eskimos from the Northwest Territories, Alaska and Greenland from a number of published sources. The data are arranged for each area progressing from relatively "traditionally" living groups (Trad.) to more "modern" (Mod.) living or more recently studied populations of the same area, and are compared with the consumer survey data collected by the U.S. Department of Agriculture in 1955. Parallel trends are seen in the Inuit of all three countries with protein losing its pre-eminent position to carbohydrate as the main source of calories. Fat intake, which was low in earlier times and more traditional populations, increased with urbanization, the increase deriving from imported foods. It may be noted that Kemp's detailed year-round study of energy flow in a small outpost population on the south coast of Baffin Island in 1967[12] arrived at almost identical figures for total caloric intake and relative contributions by protein, fat and car-

TABLE II

1964 DAILY PER CAPITA (ALL AGES) CONSUMPTION OF MAJOR NUTRIENTS IN FOUR CANADIAN ESKIMO SETTLEMENTS[12] v. 1955 U.S.A. CONSUMPTION [a]

	Total Calories	Proteins (g)	Fat (g)	Carbohydrates (g)
Holman Island	2750	280	79	230
Coppermine	2510	271	64	213
Pangnirtung and Cumberland Sound	2770	318	53	254
Frobisher Bay	2040	128	57	254
Urban area, U.S.A., 1955[12]	3200	103	155	350

[a] When comparing these per capita consumption estimates differences in population structure with higher proportion of children in Eskimo settlements have to be considered. But this may be more than offset by larger proportion of old and other physically inactive people in urban populations.

bohydrates as we had found in 1964 in small Central and Eastern Arctic settlements[20]. The relatively urbanized population of Frobisher Bay already had experienced then, a marked decline of protein and increase of carbohydrate consumption similar to or even exceeding trends seen in Alaska and Greenland, while their fat intake had increased less.

Some elaboration is required in regard to carbohydrate intake. Although the proportion of caloric intake supplied as carbohydrate differs somewhat between the settlements, the absolute amount of carbohydrate shown in Table II is similar in the traditional settlements of Holman Island and Pangnirtung to that in the more urbanized settlements of Frobisher Bay and Coppermine. As part of the influence of the whalers and fur traders, stable carbohydrates such as rolled oats and flour had become a rather traditional part of the Inuit diet. However there has been a more recent change in the actual carbohydrate component of the Inuit diet in urbanized areas. This is shown in Table IV which differentiates between rapidly absorbed carbohydrates (sugars) and more slowly absorbed carbohydrates (cereals). In eight years in Pangnirtung the consumption of sugar in all forms rose from 26 to 104 lbs. per capita and the percentage of total car-

TABLE III

COMPARISON OF AVERAGE PER CAPITA DAILY CALORIC INTAKE AND PROPORTIONAL CONTRIBUTION BY PROTEIN, FAT & CARBOHYDRATE (CHO)

Place and year of Study (Author and Ref.)	Total Calories	% of Caloric Intake As Protein	Fat	CHO
Cumberland Sound 1965 (Schaefer[20]) (Trad) *	2770	46	17	37
Holman Island 1965 (Schaefer[20]) (Trad)	2750	41	26	33
Coppermine 1965 (Schaefer[20]) (Trad)	2510	43	23	34
Lake Harbour 1967 (Kemp[20]) (Trad)	2700	44	23	33
Frobisher Bay 1964 (Schaefer[20]) (Mod) *	2040	25	25	50
Alaska Diet Survey 58-61 (Heller-Scott[20]) (Trad)	2000	28	37	35
North Alaska 1971/72 (Draper[13]) (Mod)	2500	20	39	41
N.W. Greenland 1955 (UHL[73]) (Trad)	N.A.	36	25	39
N.W. Greenland 1974 (Bang et al.[5]) (Mod)	2832	26	37	37
USDA Urban Household Consumer Survey, 1955[12]	3200	13	43	44

* Data arranged progressing for each area from relatively "traditional" (Trad.) to more "modern" living or more recently examined (Mod.) groups. Data in bottom line cite for comparison findings of USDA Consumer Survey 1955.

TABLE IV

ANNUAL PER CAPITA CONSUMPTION OF RAPIDLY AND SLOWLY ABSORBED CARBOHYDRATES IN PANGNIRTUNG-CUMBERLAND TRADING AREA 1959-1967

Year	Sugar in All Forms		Cereals & Flour		
	(lbs) Consumed	% of [a] Total CHO	(lbs) Consumed	CH_2O Content (lbs) [b]	% of Total CHO Consumed
1959	26.0	18.1%	156.3	117.2	81.9%
1960	37.6	22.4%	173.5	130.1	77.6%
1964	65.5	30.2%	201.3	151.0	69.8%
1967	104.2	44.2%	175.9	131.9	55.8%

[a] In Canada (1960) 46.7% of calories derived from carbohydrates was consumed in form of sugar and sugar products. In the U.S.A. (Urban Household Consumers Survey 1955) the corresponding proportion was 51%, but according to a more recent study sucrose consumption composed 42%, other mono and disaccharides 22%, and only 36% of available CHO was derived from starches and dextrins[1].

[b] CH_2O content of cereals and flour varies somewhat but averages 75% which is taken here as basis for calculation.

bohydrate consumed as refined sugar rose from 18 to 44% with a proportionate drop in cereal and flour from 82 to 56%[30,32].

In addition to imported carbohydrates, a small but significant amount of complex polysaccharides was consumed in the traditional Eskimo diet in the form of glycogen and glycoproteins from the liver (5%)[13], meat (muscles 0.5%)[13], skin (muktuk 18%)[28], and gut epithelias. These are eaten to a lesser extent in urbanized settlements, making the shifts from complex to rapidly absorbed carbohydrates even greater than that shown in Table IV.

The relatively recent trend towards rapidly absorbed carbohydrates in many northern native communities now exceeds the Canadian average of 100 to 110 lbs per capita per year. Data collected in Pangnirtung 1970 and 1975 and in Arctic Bay 1976 indicate that by 1969/70 per capita consumption of sugar in all forms had risen to almost 140 lbs, i.e., exceeding average Canadian consumption by 30%. It has however, remained since at that level or even slightly declined as our calculated figure of 135 lbs sugar consumption for 1974/75 in Pangnirtung and 131 lbs/per capita 1976/77 in Arctic Bay would suggest — possibly an effect of our health education against "junk food" and sweet drinks.

INFANT FEEDING OF INUIT

Changes in infant feeding practices have been even more drastic and the effect on health and life of infants more immediate and often disastrous.

Breast-feeding was usually prolonged in traditional Inuit society and lasted generally until the birth of the next infant, spaced at an average of three years later[29,31]. Supplementary feedings were usually started at four to six months of age using premasticated meat, and from at least one year of age the child increasingly participated in common family foods while still obtaining a major part of its requirements from breast milk until about the age of three.

Human breast milk provided thus all the essential nutrients for growth and also contributed immunological protection in early infancy.

The changing pattern of infant feeding practices is depicted in Table V, derived from data collected (1965) in various parts of the Canadian Arctic affected to different degrees by acculturation and urbanization[29,31]. While in hunting camps and very small settlements a large majority of children had still been breast-fed for more than 12 months, in 1955-64 the rate of children receiving such traditional nursing in more urbanized settlements had fallen to 26%. By 1973/74 the rate of traditionally prolonged breast-feeding had fallen in the Inuit to 7% and in the Indians to 1.5% and only 11% of Inuit and 4% of Indians nursed their infants the recommended minimum of six months Table VI)[24]. A con-

TABLE V

THE CHANGING PICTURE OF INFANT NUTRITION IN CANADIAN ESKIMOS

As reflected in numbers and percentages of bottlefed individuals in various groups and different types of settlements (1965) (copied from ref. #61).

Type of Settlement	Adults (17 yrs. & older)		Adolescents (10-16 yrs. incl.)		Children (1-9 yrs. incl.)			All Age Groups	
	No. Exam.	Bottlefed[a] No. & (%)	No. Exam.	Bottlefed[a] No. & (%)	No. Exam.	Bottlefed at 1 month	age 12 mos.	No. Exam.	Bottlefed at age 12 mos.
Hunting Camps	105	1 (1.0%)	45	8 (17.7%)	82	8 (9.8%)	26 (31.7%)	232	35 (15.1%)
Village Type of Settlement	88	3 (3.4%)	12	3 (25.0%)	49	14 (28.6%)	26 (53.1%)	149	32 (21.5%)
Urbanized Settlement	66	3 (4.5%)	17	5 (29.4%)	53	21 (39.6%)	39 (73.6%)	136	47 (34.6%)
Totals	259	7 (2.7%)	74	16 (21.6%)	184	43 (23.4%)	91 (49.5%)	517	114 (22.1%)

[a] Bottlefeeding was possible only for the younger adults in the Eskimo groups here discussed. It was generally only used in adopted children or after maternal deaths if no lactating woman nearby was available. All other adults were breast-fed in traditional fashion 2-4 years, i.e., until the next sibling took its place, which occurred after an average of slightly more than 3 years[51]. For most of the young adults and adolescents listed as bottlefed no exact information was available as to the exact month of life when bottlefeeding was started, although most listed in these columns can be assumed to have been started on bottlefeeding at birth or very early in infancy. For most children aged 1-9 years detailed information was obtained and those started at birth or before 1 month are listed separately besides the total number started on bottlefeeding before the end of the first year of life.

certed drive to better motivate young native mothers, who were generally more prone than mothers in their thirties to abandon traditional nursing habits, as well as an educational campaign of health workers, nurses and physicians in the Northwest Territories has in the last five years halted and largely reversed this downward trend and we are reassessing the current status of breast-feeding in Inuit and Indians in the Northwest Territories by questionnaires.

Beneficial effects of breast-feeding are not limited to the provision of all essential nutrients in ideal composition, perfect cleanliness and digestability but most important, human milk contains very important immune bodies against specific and non-specific infectious agents.

These immune bodies and cells transmitted by mother milk are the first line defense against infections in the gastrointestinal and respiratory tracts — the latter of particular importance in a climate and environment so obviously harsh and damaging to upper and lower airways.

Less often discussed but perhaps of equal importance for modern man is early hypersensitization to foreign proteins contained in cow milk and other artificial infant formulae absorbed by the relatively immature gut of newborns or older infants after intestinal infections, more frequently encountered in unhygienic conditions in the absence of mother milk.

In the next chapter some most obvious examples are given of effects of nutritional change on individual health, disease and death. But the profound effects of nutritional change in infancy extend beyond these relatively obvious and fairly easily demonstrated examples.

Obesity and craving for sweets is a relatively new and increasing problem in our northern natives[53]. Although multifactorial pathogenesis is most likely, reports link childhood obesity to sugar-added formula feeding and early introduction of solid supplements. This may be pertinent to our situation, although we have not yet enough data at this stage available from the Northwest Territories to contribute to this question. We found, however, that breast-fed Inuit children walked significantly earlier and had higher hemoglobins than bottle-fed children[53].

TABLE VI

INFANT NUTRITION
VARIOUS ETHNIC GROUPS N.W.T. 1973/74[44]:
EXCLUSIVE BREAST-FEEDING TO AGE:

	1 Month	3 Months	6 Months	11 Months
Inuit	36.7%	19.9%	10.9%	7.4%
Indian	17.2%	9.4%	4.4%	1.5%
White	28.5%	11.9%	4.8%	2.3%

But the effects of changes in infant feeding patterns extend also beyond the children individually affected. Their mothers were burdened with many more pregnancies and a veritable population explosion occurred across the Arctic between the early 1950's and mid 1960's[29,51,54] limiting care, nutritional resources and space for other family members and resulting in all kinds of demographic, social and economic repercussions.

THE DENE

The Dene are at present, and probably always were, less numerous than the Inuit in the Northwest Territories (7,999 in mid 1978). Although doubling their numbers in the last 25 years their proportion of the total population of the Northwest Territories has fallen from 21% in 1960 to less than 18% in 1978, while a relatively higher birthrate kept the Inuit at almost 35% of the Northwest Territories population, i.e., their proportional share of the Northwest Territories population slipped only by one percentage point despite a large influx of non-natives in the last two decades (Table VII).

In contrast to the Inuit, whose principal native food, the seal, appears to be a very resilient resource, the Dene although better off in that respect than the Indians in the provinces, are less favourably placed, in that their main game resources have decreased substantially due to greater hunting pressure, use of new weapons, new hunting and fishing methods and/or other modern changes. Use of native food resources and persistence of traditional nutritional habits are, however, still of great economic value, and perhaps even of greater importance for the physical and sociocultural well-being of the Dene. Since the Dene tribes shared with the Inuit many parallel or even identical nutritional habits (e.g., concerning infants and young children) I shall limit my discussion to obvious differences.

Research knowledge derived from other Northern Indians (Heller and Scott — Alaskan Indians[25,35], Berkes[4], Farkas[19,20] — James Bay Cree Indians) with similar habits and food resources as those of the Northwest Territories has also been used where applicable, as my own and indeed other systematic research amongst the Dene has been less ample and detailed than that amongst Inuit.

Pre-contact Northern Indians lived, as did the Inuit, primarily from subsistence hunting and fishing, and their carnivorous diet was similarly rich in protein and low in carbohydrates. There is general agreement that the aboriginal Indian's diet was also low in fat, as their main prey, caribou, moose and other deer, have very lean meat and limited fat stores. Furthermore the fat derived from these traditional sources has quite different characteristics from imported fats such as lard, which became an important food staple during the era of fur trading, and dairy fats increasingly used more recently. I referred above to the sevenfold higher content of unsaturated fat in meat from caribou v. beef[13]. Marine fats derived from fish and beaver, important items in aboriginal Indian diet, are also much less saturated than that from dairy products and domestic animals[13,30].

TABLE VII

ETHNIC MAKE-UP OF N.W.T. POPULATION 1951-1978

	INUIT		INDIAN		OTHERS [a]	
	No.	% of Total	No.	% of Total	No.	% of Total
1951 (b)	6,857	(42.8%)	3,803	(23.8%)	5,344	(33.4%)
1961 (b)	8,207	(35.7%)	4,796	(20.9%)	9,995	(43.5%)
1968 (c)	10,736	(35.4%)	5,972	(19.7%)	13,596	(44.9%)
1978 (c)	15,374	(34.5%)	7,999	(17.9%)	21,260	(47.6%)

(a) Others although predominantly made up of Euro-Canadian immigrants includes an estimated 10% of Non-status Indians, Metis and other part native persons.

(b) According to official census figures 1951 & 1961.

(c) According to H&W Canada figures published in Annual Report, Medical Services, N.W.T. Region, but figures calculated by territorial agencies[24] are almost 10% higher for most years in the last decade. The difference is explained by use of mid year figures and omission of short-term transients in the Annual Health Report and by end year figures and inclusion of short-term transients by territorial agencies.
Differences affect mainly "Others" and practically not at all the native population groups. Differentiation into ethnic groups make figures from the Health Report more suitable for our purposes.

Thus, while there were many similarities between basic nutrient composition and nutritional habits of traditional Northern Indians and Inuit, some important differences should be noted.

Vegetable resources in the North, mainly herbs, roots and berries, often dried for year-round use, were essential sources of vitamins and allowed the Indians to cook their meat and smoke their fish. In addition, berries, plant saps and roots, and for some, wild rice, provided more carbohydrates than available to the Inuit. So while for the Dene also, animal protein provided the main bulk of calories, somewhat more carbohydrates but fewer fats were available in the traditional Dene diet. As well, the Dene were introduced to flour and cereals, the staples of the fur trade, earlier than were the Inuit.

The relatively greater consumption of CHO in traditional Dene v. Inuit diets may explain that the hepatomegaly noted in Inuit as late as 20 years ago and attributed to protein gluconeogenesis, was not reported in Indians; but many explorers refer to the consumption of huge amounts of lean meat or fish (6-8 lbs/day in times of plenty) by Dene and other Northern Indian hunters as well as Inuit in early contact times. It is interesting to note in this context that similar large amounts of meat consumption were reported by ancient writers, e.g., Homer — and should not be dismissed summarily as "poetic exaggerations" for predominantly carnivorous populations.

TABLE VIII

SOURCE OF FAMILY FOOD SUPPLY IN FAMILIES WITH NEWBORNS, N.W.T. 1973/74 ACCORDING TO ETHNIC GROUPS[44]

	Inuit (420)	Dene (216)	White(275)
Mainly Store	21%	41%	94.5%
Half Native	62%	57%	5.0%
Predominantly Native	17%	1.4%	0.4%

Rapidly absorbably CHO are a source of immediately available energy, filling a physiological need in times before refineries inundated modern man with sugar. That may explain the taste for sweets common to all human populations. When it became available and affordable sugar and junk food consumption rose to unhealthy levels in Dene and Inuit, whose traditional native diet had been particularly low in fast absorbable CHO.

TABLE IX

PREVALENCE OF FREQUENT (AND INFREQUENT) CONSUMPTION CLAIMED FOR VARIOUS TYPES OF NATIVE FOOD RESOURCES IN DIFFERENT ETHNIC GROUPS, N.W.T. 1973/74[a]

	Inuit		Dene		White	
Fish	56%	(43%)	80%	(17%)	60%	(40%)
Caribou and Moose	81%	(17%)	74%	(24%)	30%	(60%)
Sea Mammals	37%	(50%)	1%	(4%)	0%	(20%)

[a] Only families claiming to obtain one half or more of food supply from native sources are included in this tabulation, which excludes therefore 21% of Inuit, 41% of Dene and 94.5% of Whites. From PIMMS[44].

In aboriginal times population growth was limited by relatively low productivity of a hunting economy compared to agriculture and absence of easily stored staples such as cereals to bridge frequent famines due to natural wildlife cycles or changed migration routes.

The transition from an exclusively hunting and fishing subsistence to a fur trapping economy and with it the dependence on cereals, came much earlier to the Dene than to the Inuit, starting almost 200 years ago. A marked further decrease of traditional food consumption by Dene occurred in the last 20 - 30 years. By 1973/74 41% of Dene v. 21% of Inuit households in the Northwest Territories admitted to derive most of their food supply from imported store food as shown in Table VIII[44]. Fish topped the list of frequently eaten native food in Indian households, while caribou had displaced seal as the most frequently eaten native meat for the Inuit (Table IX)[44], reflecting a recent trend of preferring caribou to seal meat, especially by younger Inuit. This preference has been complemented by a temporary resurgence of caribou herds during the last 20 years and greater land mobility of hunters on skidoos. But this trend may have to be reversed for reasons to be discussed in Chapters III and V.

Effects of such drastic changes in nutritional habits in children and adults were manifold. Some new afflictions are so easily recognizable and their temporal relation to nutritional change so obvious that often the natives themselves stress their association to "white man's food". Dental caries, acne and obesity are examples and will be discussed first. We shall continue with less obvious ailments such as iron deficiency anemia and vitamin deficiencies, often discovered only by laboratory methods, diseases which are not questioned, however, as purely nutritional diseases.

Diseases found more often now in northern natives but more complex in causation, such as gallbladder disease, diabetes, hyperlipoidemia and arteriosclerosis will follow.

Other diseases (otitis media, recurrent unspecific chest diseases in children) although of greatest clinical importance in recent times, and other relatively new biological phenomena (secular growth acceleration) will be left to the end of our discussion as there does not exist yet general agreement in regard to causative factors, but our observations in northern native population groups have helped to identify hitherto unsuspected nutritional factors, likely playing a leading role.

DENTAL CARIES

Perhaps the easiest observed and accepted example of deleterious health effects of nutritional change in Indians and Inuit is dental caries. Graveyards of rotten stumps necessitated in recent years complete extractions in many children and young adults. Old natives, especially in remote places, are living testimony to the perfectly healthy teeth and gums in traditional times. With aging, especially, in Inuit women who had to soften the families' boots by chewing, attrition might wear the teeth down, but the retention of clean and complete rows of teeth into early senescence was the rule rather than exception. Detailed documentation of the dental health status in various age groups at various stages of dietary change are available from Alaska[36] and Canada[37]. The teeth of prehistoric Eskimos in archeological material confirm the complete or almost complete freedom from caries in pre and early contact times.

While children and adolescents due to their greater inclination to consume sweets, as well as the greater vulnerability of their developing teeth, reflect first and most severely the changes in the "sugar climate", many adult northern natives may also have a lowered resistance to dental caries when consuming sweets, due to the fact that chewing had induced attrition of teeth surfaces with loss of enamel[38].

Other effects of nutritional changes which are well recognized by natives themselves are acne and obesity. Acne vulgaris was unknown or rare in traditional native societies. Its appearance in individual cases as well as prevalence in various population groups was clearly related to consumption of sweets, chocolates and nuts[52,57].

Obesity was formerly virtually never seen in young and middle-aged men but occurred occasionally to moderate degrees in older men and somewhat less infrequently in older women of Indian and Inuit societies. We have demonstrated recently[53] that a striking increase of obesity occurred in the Inuit of Inuvik compared to those in Arctic Bay matched for age and sex. Although excess caloric intake in food and drink (sweet drinks, alcohol) is perhaps the most important factor we must not underestimate the effect of a marked decrease of energy expenditure due to a decline in hunting activity.

A number of other health consequences of nutritional change in Indians and Inuit have been uncovered by laboratory examinations. Iron deficiency anemia has become very prevalent in Indians and Inuit who abandon traditional diets which supplied iron in the meat of game. Women and children who have high iron requirements are the most sensitive indicators of an iron deficient diet. When forced by the declining caribou herds to live mainly on fish and imported staples, Inland Inuit groups showed significant degrees of iron deficiency anemia 20 to 30 years ago while Coastal Inuit continued to have excellent red blood cell indices[39,49]. They remained that way until they moved from hunting camps to settlements in the mid and late 1960's at which time they also started to show iron deficiency anemia[9,55].

We have noticed in examinations carried out recently at Nanisivik on Northern Baffin Island, a tendency for the Eskimo miners there to be more iron deficient than the white miners eating in the same mess. Twelve of 24 Inuit miners fell in 1978 below the 5th percentile of hemoglobin levels v. 2 of 13 white miners. Both groups consumed for more than six months the same mess food. In contrast there had been no change of hemoglobins in Inuit mine employees commuting to Arctic Bay and continuing to eat at least partly native food. Two of 17 of these fell in 1976 (before opening of mine), 1 of 10 in 1978, below the 5th percentile. These

are small and marginally significant figures needing further corroboration[16] but there are other suggestions[3,10,38], that perhaps Inuit develop iron deficiency more readily, and respond to oral iron treatment more slowly than one would expect. If this were so it may not have had any significance aboriginally since seal meat contains 6-10 times and seal liver 15-20 times more iron than beef meat and liver respectively[39]. This hypothesis must be regarded as unproven at this time, but because it has important implications it should be tested by definitive studies on absorption and metabolism of iron.

VITAMIN AND CALCIUM DEFICIENCIES

Vitamin A: Marginally depressed serum levels and suggestive clinical signs of Vitamin A deficiency were found in Alaskan natives in the 1950's despite relatively rich Vitamin A content of native food resources[25,35]. Nutrition Canada found also 1972 lower Vitamin A serum levels in Indians and Inuit than in the general population survey, and estimated the dietary intake of Vitamin A or precussors to be relatively low in Indians[42] and far below the national level in Inuit[41]. Our own surveys in 1976-78 demonstrated generally higher Vitamin A levels in Inuvik than Arctic Bay, where some 15% of children and adolescents had critically low serum levels but without overt clinical signs of Vitamin A deficiency[53].

No significant Vitamin B deficiencies were found in the Canadian North. Predominantly carnivore populations derive sufficient B vitamin from meat and particularly organ meats, while the satisfactory levels found in northerners living mainly on imported food staples may be explained by the fact that for years only B vitamin enriched flour can be sold in the Northwest Territories.

In regard to Vitamin C which we derive mainly from fruits and fresh vegetables and which are naturally absent or in short supply most of the year in the North, explorers, missionaries and other early contacts were puzzled to find no evidence for scurvy in northern natives. Reasons for this will be presented in the next chapter. Some cases have been observed however, particularly in Northern Indian infants and children in population groups changing from native to imported foods and replacing breast with bottlefeeding[46,74].

Nutrition Canada reported relatively low Vitamin C blood levels in Indians[42], and critically low levels in the Inuit[41], but markedly higher levels were found a few years later by Perry et al.[46], and by us in the Eastern Arctic and Inuvik[53], which may be explained at least in part by the vitamin supplementation programs undertaken by Medical Services in the meantime and perhaps also by greater consumption of "Tang" and other Vitamin C enriched drinks.

Folate serum levels were also reported by Nutrition Canada as generally lower in Indians[42], and markedly lower in Inuit[41], than in the national sample. No definite clinical signs of folate deficiencies were found by them nor by us (1976-78) in Inuvik and Arctic Bay surveys, when very few younger natives but some 20% of middle-aged and elderly Inuit in Inuvik, and slightly more including some younger adults in Arctic Bay, were found to have less than 2.5 ug/ml[53] and were therefore at "high risk" according to Nutrition Canada. It should be noted that in 1972 Nutrition Canada found approximately four times as many Inuit at high risk for folate deficiency. These better results in recent examinations appear real as analyzed under similar conditions, the same time of year and performed by the same laboratory, and parallel similar improvements described above for Vitamin C status of the Inuit (1976-78 v. 1972). They are, however, more difficult to explain as not all vitamin supplements used contained folates nor do soft drinks and fruit drinks include folate when adding Vitamin C. There is also no evidence that traditional native sources of folate, i.e., fresh meat, especially organ meat such as liver, kidney and glandular tissue were gaining favour again, but consumption of fresh imported vegetables and fruits, our main source of folates, has no doubt increased and is higher in the Western than Eastern Arctic.

The absence of rickets or milder and other disturbances of calcium metabolism in northern natives, who live in a climate and latitudes not conducive to much generation of Vitamin D by exposure to the ultraviolet light of the sun and who lacked in their traditional diet the main sources of calcium of rich and poor people, namely milk and cereals, puzzled explorers, missionaries and other early observers as much as absence of scurvy did. The traditional native diet was rich in the fat soluble vitamins A and D, which are very plentiful in northern fish and sea mammals. Their diet offered, however, only a fraction of the 0.8-1g calcium daily consumed by most North Americans but probably more than usually realized was obtained from organ meats such as liver and especially from chewing the spongious portions of bone observed to be practiced to the greatest extent by pregnant and lactating women[37]. Furthermore calcium from such sources has likely a greater bio-availability than calcium complexed with phytates as in cereals and other plant products.

Some adaptation to lower calcium intakes has been shown in people by increasing calcium absorption by a Vitamin D dependent mechanism — a process possible for Inuit traditionally amply supplied with Vitamin D[13].

Some cases of rickets were reported in Indian[40,73], and Inuit children[21], after acculturation had eroded much of their traditional nutrition habits, and were found especially in bottlefed infants. Nutrition Canada found Vitamin D intakes in Indian and Inuit children below national standards and calcium intakes low in Indian children under five years and Inuit children under 10 years of age, but no signs of rickets were found and serum calcium and phosphorus levels did not indicate any Vitamin D deficiency. Inadequate calcium and Vitamin D intakes were also reported for adults, particularly the elderly and pregnant women. No clinical signs of osteomalacia were described but means and distribution of serum calcium levels were markedly lower than in the natinal sample, especially in pregnant and elderly Inuit women and men[41,42]. We found in our 1976-78 surveys in Arctic Bay no abnormal serum calcium and phosphorus levels. They were not analyzed in Inuvik. No clinical signs of rickets or osteomalacia were found[23]. Mazess and Mather found, however, compared to other North Americans a larger and earlier loss of bone mineral content in aging North Alaskan[39], and Canadian Inuit[39], affecting both sexes. It is unknown to what extent this accelerated rate of bone resorption is attributable to their high protein diet with high acid and phosphorus loads causing calciuria or to their low calcium intake, but it is probably due to a combination of these factors. Decline of the habit of chewing fish and spongious bones, the main source of calcium in traditional times, while maintaining a diet still fairly high in protein, particularly by the elderly, may have accentuated the accelerated calcium loss in the elderly Inuit, but frequent observations of marked bowing of the legs, especially in elderly multiparous women, and of marked dorsal kyphosis in both elderly women and men some 20-30 years ago indicate that the problem of accelerated bone loss did exist even then, at least for the oldest age groups!

In regard to vitamin and mineral deficiencies we may conclude that while clinical evidence for gross deficiencies was rare or absent in various recent surveys, dietary intake studies and biochemical analyses have found certain age and sex groups of Inuit and Northern Indians at moderate or high risk to develop deficiencies of vitamins A, C, D and folates and the minerals iron and calcium.

Excess consumption of calories in all forms and especially sugar leads to an increase in cholesterol and other blood lipids. We found blood lipids to be much higher in Inuvik than in Arctic Bay with parallel differences in skinfold thickness in both sexes and all age groups tested[55].

Women in Inuvik have almost 10 times the incidence of gallbladder stones compared to Arctic Bay women[53,57], a not unexpected finding in view of the differences in obesity and serum cholesterol levels and the very high prevalence of gallstones in acculturated American[48], and Canadian Indians[74], found associated with obesity.

Studies of carbohydrate metabolism showed that approximately half of the Inuit and to a lesser extent Northern Indians do not respond normally to an oral glucose load with a rapid mobilization of insulin[58]. Therefore there is a postprandial hyperglycemia. However normal insulin reactions and normal blood glucose levels were found in the same Inuit and Indian subjects when glucose was administered intravenously or given orally after a protein-rich meal[58]. This suggests that their insulin release is stimulated by gut-receptors more sensitive to protein (amino acids) than to glucose. This trait appears to run in families and not to be influenced by recent dietary history[58], suggesting that it is inherited rather than acquired.

Intake of large amounts of sugar without meat, as is often nowadays practiced by northern natives, tends to subject such people to high and erratic blood sugar levels and inappropriate insulin reactions, mimicking the early stages of diabetes. It may be of interest that while the clinical diagnosis of diabetes is still relatively seldom made in Inuit (less than twenty cases have been proven in Canadian Inuit to date) all confirmed cases were living in large urbanized centres exposed for a longer time and to a greater extent to our form of diet and way of life. Campbell found in surveys of history of sugar consumption and epidemiology of diabetes mellitus in various races (African and Asian) in South Africa, that there was an interval of approximately 20 years between the time sugar consumption rose sharply and a parallel increase in clinical cases of diabetes[7]. We may be dealing with a similar situation in the Canadian Inuit.

Diabetics are known to have a tenfold increased risk to show calcification of leg arteries with advancing age. Our finding of a significantly higher rate of radiologically visible calcification of leg arteries in elderly Inuit in settlements where also higher scores of DMFT (diseased, missing, filled teeth) reflected the "sugar climate" there in the past[37], points in the same direction, suggesting that the limited and conditional glucose tolerance found in 50% of Inuit and in a lesser proportion of Northern Indians may be a greater poten-

tial danger than so far reflected in diagnosed cases of clinical diabetes.

Related to this may also be our finding of significantly higher aortic indices, a radiological measurement of elongation and widening of the aortic arch and believed to be perhaps the best measurable reflection of atherosclerosis of large arteries, in middle-aged and elderly native men in Inuvik when compared with those from Arctic Bay[53].

There was also an age-related increase of blood pressure, as generally found in modern societies, in Inuvik, but not in Arctic Bay[53] and Igloolik men[39]. Low salt intakes from all sources recorded in native populations of the Canadian Eastern Arctic[51], Alaska and Greenland[23], calculated to range from 2-4g/day in their traditional diets, and increasing salt consumption calculated from sales in northern stores since[50], is in this context of interest. Although perhaps not solely related to nutritional change, this probably plays a decisive role and it may be easier and more practical to influence nutritional than other more complex factors likely related to our modern civilization.

NUTRITIONAL CHANGE AND INFANT HEALTH

Particular emphasis and special discussion appears warranted for the effect of nutritional change on disease and health in infancy and childhood and on growth and development for the following reasons. At no time of life has mode and quality of nourishment such an immediate influence upon morbidity and mortality as in infancy. Formerly uncommon diseases such as chronic otitis media[61] and recurrent or chronic pneumonia[22,27] became prevalent in Indians and Inuit. We could clearly demonstrate significant relationships of this increased morbidity to changes in nutrition habits[53,57,61]. On the other hand, some phenomena of growth and development observed worldwide and generally attributed to "better" nutrition, such as secular growth acceleration and advancement of menarche were also documented in Canadian Inuit[53,60]. These appeared in temporal sequence and local variation was closely linked to unfavorable nutritional changes found associated with iron deficiency anemia[9,53,56] and above quoted morbidity.

CHRONIC AND RECURRENT OTITIS MEDIA

Apparently uncommon in previous generations, this condition has become a very prevalent and costly chronic health problem in younger Inuit and Indians. We found in 1965 that Inuit children bottlefed before the end of the first month had sixfold higher morbidity of chronic ear disease than those receiving traditionally prolonged breast-feeding. Somewhat smaller but still significant were differences between children with shorter periods of breast-feeding compared with those bottlefed from birth[61]. This relationship was confirmed in a number of later investigations in northern native populations[29,44,53,71], as well as Whites[11,44].

Pneumonia was, and still is, the leading cause of infant mortality in the post-neonatal period for Inuit and Indians. A large scale survey of Maternal and Child Health of Canadian Registered Indians in 1962 found in bottlefed Indians an eightfold higher rate of pneumonia than in breast-fed infants[70]. Indian and Inuit infants appear particularly prone to pulmonary complications of viral infections[27], especially when bottlefed[53,61]. Somewhat smaller differences, but still significant, have been found for the rates of gastroenteritis[11,53,70] and in post-neonatal infant death rates from all causes[70].

TABLE X

DAYS AWAY FROM HOME DUE TO ILLNESS (PIMMS, 1973/74, MEANS ± S.D.)[44]

	Breast-fed 3/12 (N)		Bottle before Age 1/12 (N)	
Eskimo	(129)	4.25 ± 11.19	(250)	16.60 ± 23.44
Indian	(25)	5.04 ± 9.53	(168)	16.98 ± 23.83
White	(31)	0.39 ± 0.99	(173)	2.88 ± 6.88

Hospitalization in infancy is depicted in Table X and shows the influence of breast-feeding on both the frequency and the duration of hospitalization. There were highly significant differences in hospitalization rates in all ethnic groups. Bottlefed Dene and Inuit infants were three to four times more often and/or longer in hospital than those breast-fed. For White infants the difference was more than sevenfold but for them the rate was much lower than in natives irrespective of mode of infant nutrition. A number of reasons for these differences are discussed in detail elsewhere[44]. The greater risk for northern native infants which is mainly due to unfavourable environmental conditions, not easily amenable to change, makes it especially important for us to encourage and facilitate continuation or re-establishment of breast-feeding for a minimum of six months, and preferably much longer.

Availability and Nutritional Value of Country Food Resources

AUTOCHTHONOUS FOODS

Although some more detailed and up-to-date information may be presented by wildlife officials in regard to availability of native fish and game food resources some rather broad observations may be appropriate. We shall also present data on their nutritional value.

Statements are often made by protagonists for "development" of mineral and other non-renewable resources, and repeated uncritically by the media, by politicians and by others that the growth of native populations, their movement from small hunting camps to larger settlements, and the decline of local food resources have — for all practical purposes — removed traditional food resources as a means of sustenance. Demographic and physiological facts discussed above and data presented in Table VIII and IX attest to the continuing vital importance of local food resources in the supply of protein, essential vitamins and minerals for the majority of Inuit and Dene in the Northwest Territories. It is our contention that with better resource exploitation, preservation and distribution, especially of sea mammals, these resources could supply a major proportion of the protein requirements also for the non-native residents of the Northwest Territories as well!

LAND GAME ANIMALS

The most important source of meat for Inuit and Dene bordering the Barren Lands are caribou, and for Dene living in the Mackenzie Basin, moose.

A series of drastic declines of the huge caribou herds of the Arctic tundra caused catastrophic consequences in the forties and fifties for the "Caribou Inuit" of the Barren Lands and their southern neighbours the Chipewyan Dene. There obviously was a partial but encouraging comeback during the 1960s and early seventies, attributed (with some justification) to protective hunting regulations and movement of people from depleted caribou areas to coastal settlements.

The advent of the skidoo with its speed and range increased the hunting pressure of both native and non-native hunters. A downward cycle has reached catastrophic proportions on the North Slope of Alaska. Surveys conducted there between 1970-76 showed a decline from approximately 250,000 to 50,000 caribou. I am not aware of any recent data to support a similar trend in the Canadian Arctic, but anecdotal information from Inuit in a number of settlements in the Central and Eastern Arctic make me apprehensive that we may also suffer a new decline, for which the skidoo is an important factor but also contributed to by increased air traffic, drilling, pipeline construction and other such activities.

The moose situation is quite different. This species has extended its northern range substantially during the last two centuries due to the trend of post-glacial northward recolonization of certain types of plant and forest cover. This and improved forage after forest fires have increased rather than decreased moose populations in the Northwest Territories and made moose rather than caribou the prime big game meat provider for Dene tribes, especially in the Slave, Liard and Mackenzie River valleys.

Other large land mammals such as muskox, bison, black bears, and grizzly bears and the polar bear are of limited importance as meat sources. For bears special safeguards (thorough boiling) are indicated because of heavy trichinosis infestation in approximately half of all kinds of bears.

Small game such as snow rabbit, muskrat, beaver and other fur bearers, including foxes — although often forgotten and neglected as a food source — are not less but rather more plentiful than in former times when they were used for food, particularly at peak times of their cycles. They served as vital supplements when larger game failed. Their nutrient composition and food value is quite similar to that of other game meat. This should be stressed in educational efforts to take advantage of the variety of native food resources available.

Exploitation of migratory birds; geese, ducks and others, were and still are in certain areas, of great importance even if seasonally limited. They are at present exploited probably to the extent permissible for sound conservation. For this reason discouragement of harvesting eggs of geese and ducks was, and is, indicated while perhaps collection of sea gull eggs, which also were avidly sought, could be encouraged without harm.

SEA MAMMALS

Certainly, the most important staple food resource for Inuit in the past were sea mammals. The common jar seal is the most ubiquitious of these but at present there is considerable waste of this most valuable native food resource. It has the best potential for increased exploitation and could not only fill the protein requirements of the Inuit but could supply also some, if not all, protein requirements of other Northwest Territories residents, since in these times there is a reduced native meat requirement because of mixed diets and disappearance of dog teams.

FISH

Marine and fresh water fish resources are very substantial in most areas of the Northwest Territories (except in the High Arctic) and should continue, with proper management, to supply a substantial proportion of protein requirements for both Dene and Inuit, but are unlikely to satisfy all requirements of non-native residents. Most northern species (especially Arctic char and lake trout) will not support large-scale fishing and export operations because of slow growth and slower regeneration of depleted stocks in northern waters. This has forced abandonment of many fish co-op enterprises which were established in the 1950s and 1960s in disregard of this fact.

Our remarks re availability and potential for small game apply equally to plant foods such as berries, roots and seaweeds. These played an important role in traditional Indian and Inuit diets but were either completely overlooked or grossly underrated by ethnologists and medical researchers alike. The carrying capacity of the land and the sea has not much changed in recent times and cycles of scarcity and abundance are less extreme for plants than for animals such as the snow rabbits. Here education and field excursions by primary and secondary school classes engaging experienced natives as teachers may help a great deal to awaken renewed interest.

Finally a definite potential exists for supplementing vegetable requirements by local gardening or greenhouses. More promising in future are hydroponic arrangements. We should not forget that in transitional times White missionaries and traders grew substantial amounts of vegetables such as cabbage, lettuce, carrots and potatoes in gardens in the Slave and Mackenzie River basins; and that practically any other garden product, including tomatoes, was produced in greenhouses, sun porches and windows. This practice was successfully adopted by many native and Metis people at that time but has largely been abandoned in recent years when imported foods became more available.

TABLE XI

PROTEIN & FAT CONTENT OF COMMONLY-EATEN MEATS[a]
g/100 g Edible Portion — Uncooked

Alaskan Eskimo Diet			United States Diet		
Item	**Protein**	**Fat**	**Item**	**Protein**	**Fat**
Caribou	27	1.2	Veal Side	19	12
Moose	26	1.1	Chicken	20	13
Seal	32	1.8	Pork Side	12	45
Whale	24	0.7	Lamb Side	16	28
Oogruk	27	0.4	Beef Roast	17	23
Polar Bear	26	3.1	Beef Steak	16	25
Walrus	27	12.0	Hamburger	16	28
Whitefish	25.8	1.3	Frankfurter	14	21

(Trout and char similar; dried fish has about twice the protein and fat content)

Note that in general game meat and fish are much richer in their nutritionally important protein content (almost double) while having much less potentially harmful fat interspersed in their muscle fibers than the meat of domesticated animals.

[a] Adapted from Table XXIX and Appendix II, Mann et al., I CNND Survey of Alaskan Eskimos. Am. J. of Clin. Nutr., Vol. 11, July 1962, Pages 31-76[35].

TABLE XII

COMPARISON OF COMMONLY-EATEN DOMESTIC VEGETABLES AND FRUITS WITH EDIBLE GREENS FROM THE JAMES BAY QUEBEC AREA[a]

	per 100 grams				
Garden Vegetables	Vit. A (i.u.)	Ascorbic Acid (mg)	Wild Vegetables	Vit. A (i.u.)	Ascorbic Acid (mg)
Cabbage	130	51	Bistort	-	158
Celery	240	9	Dandelion	800-14,000	30-66
Spinach	8,100	51	Fireweed	18,708	220
Green Peppers	420	128	Lyme Grass		43
Peas (raw)	640	27	Mountain Sorrel	8,900	40
Carrots (raw)	11,000	8	Rose Root	4,106	68
Beets (boiled)	20	6	Lambs Quarter	11,600	80
Potato (boiled cooked)	trace	16	Scurvy Grass	4,546	111
Tomato (raw)	900	23	Sea Purslane	5,753	42.5
Orange	200	50	Willow Leaves	18,300	190
Apple	90	4	Violet Leaves	8,258	210
			Cloud Berries	210-235	158-475

[a] From report on the Waswanipi Cree by C. S. Farkas & H. Feit[19].

NUTRITIONAL VALUE OF VARIOUS INDIGENOUS NORTHERN FOODS

Table XI compares protein and fat content in native Alaskan meat and fish with that from imported meat[20]. Game and fish are very rich in protein, generally having almost twice as much as imported commercial meat. Conversely native animal foods are low in fat compared to that found in feedlot finished animals whose "tenderness" is due to "marbling" of the meat, i.e., fat interspersed between muscle fibers. We also collected indigenous meat and fish samples from the Canadian North which were analyzed by MacDonald College[21], and the Nutrition Laboratory in Ottawa, and their analyses showed similarly high protein but a somewhat higher fat content than depicted in this table, particularly in samples collected of dishes prepared ready to be eaten[20].

As noted earlier the fats were less saturated not only in the sea mammals and fish, where this was to be expected, but also in beaver, muskrat and polar bear. Caribou also had more unsaturated fats than beef[13,20].

TABLE XIII

LEVELS OF ASCORBIC ACID IN NATIVE FOOD COMMONLY USED BY CANADIAN INDIANS[a]

Food	Vitamin C		Amount of Meat Supplying 30mg Vit. C[b]
	Per 100 g	Per 30 g (1 oz.)	
Moose	4 mg	1.20 mg	25 oz
Beaver	2 mg	0.6 mg	50 oz
Hare	3 mg	0.9 mg	33 oz
Lynx	3 mg	0.9 mg	33 oz
Ptarmigan	7 mg	2.1 mg	14 oz
Geese	5 mg	1.5 mg	20 oz
Loon	2 mg	0.6 mg	50 oz
Organ Meats	54 mg	16.2 mg	2 oz

[a] From report on the Waswanipi Cree by C. S. Farkas & H. Feit[19].

[b] i.e.: The recommended daily intake of Vitamin C.

Seal meat and seal liver compared to beef meat and beef liver were found to be richer sources for a number of elements such as calcium and magnesium, but particularly iron. Seal meat had 6-10 times more iron content than beef muscle, and seal liver compared with beef liver was 15-20 times richer. Seal is also a better source for most vitamins of the B group except for B6 and folacin, and caribou meat exceeded seal meat in B group vitamins[30].

Table XII demonstrates the higher concentration of vitamins A and C in wild berries and plants used by Cree Indians of the James Bay area compared to garden vegetables. The high vitamin C content of rosehips is also well known. Vitamins A and C and folacin, as well as minerals are supplied by seaweed and many other plants used by northern natives but not included in this table. Such plants and fruits are still used to some extent by Northwest Territories native people and there is an almost unlimited potential of much wider use by most population groups in the Northwest Territories to be discussed in the final chapter.

Finally we should draw attention to the high vitamin content of organ meats such as liver, kidneys, etc., (Table XIII) which were traditionally eaten first and which were preferred to other meats. Consumption of these, and therefore their role as important sources of vitamins and trace minerals, has declined severely, not only due to a decrease in native meat consumption generally but also due to a change in taste of the younger generation who have been influenced by our "steak" culture.

Judicious education as to the innate wisdom of traditional native food preferences in nutritional terms may help to counteract this trend away from nutritional health and sound economy.

Availability, Cost and Nutritional Value of Imported Food Resources

Availability of imported food items in northern communities is dependent on existing facilities and economics of transport, preservation and storage as well as local market conditions which, in turn, are influenced by population size, local needs, taste preferences and purchasing power. Any one of these factors alone or most often a combination of several or all of these factors limit severely number and choice of imported food items.

Cost of available imported food items increases according to means of transportation (by water, road or air), distance, quantity of shipment and marketing conditions, causing price differences ranging from a few percent above southern market prices for certain staples shipped by ship, barge or truck, in larger and closer settlements, to multiples of the southern market price for perishable goods transported in small airplanes to remote small settlements.

Stiles and McLean[20], surveyed availability and cost of imported food items in 1974 in a number of representative northern communities. We copy here their Tables 3-5, which show how many items were found available in local northern stores from an arbitrary "food basket" of 86 items. The authors considered stores containing 75 or more of the listed 86 items as "fully stocked" whereas availability of 50-75 items would characterize the store as only partially stocked and stores stocking less than 50 items could not be considered seriously involved in supplying all or most food requirements of local households. It should be noted here that their survey included Snowdrift and Wrigley but not Trout Lake or Lac La Martre, where as shown in enclosed sample tables* copied from the survey conducted in 1979 by the N.W.T. Nutrition Liaison Committee[21], availability of various commercial food items was even lower and more comparable to that found in Pelly Bay and a number of other medium and small settlements in the High and Central Arctic (e.g., Pond Inlet, Nanisivik, Repulse Bay, Whale Cove) which also were not included in the 1974 survey by Stiles and McLean.

The N.W.T. Nutrition Liaison Committee received completed check lists from 33 of 64 communities in the Northwest Territories, thus considerably expanding and updating knowledge on local availability and cost of imported food in the Northwest Territories. They tabulated their collected data in relation to "at risk" nutrient content, i.e., protein, iron, calcium, vitamin C, folic acid, vitamin A, riboflavin, thiamin and niacin, and cost per specified average meal servings. This is an approach useful to and preferred by nutrition consultants and dietitians, but makes comparison with data collected by food marketing consultants difficult in regard to cost calculation. The amount of data collected and tremendous work-up make this study a most valuable cornerstone to support further action. However, in order to estimate the cost for providing a reasonable variety of nutritious food to residents of various communities in the Northwest Territories and to arrive at valid recommendations for necessary improvements the following additional information should be obtained as soon as possible by the appropriate branches of the Government of the Northwest Territories in collaboration with home economists:

(a) Extension of the questionnaire survey undertaken by the N.W.T. Nutrition Liaison Committee to the 31 communities from which no completed forms were received.

(b) Questionnaire sheets should be used from the original 1979 and extended to estimate normal food basket costs for different categories of families in all types of settlements, taking into account availability, usage and cost of local food resources.

The latter obviously are different for, e.g., a transient civil servant and his family and a local hunter or trapper, who may provide all his family's protein requirements at very reasonable cost by fishing and hunting. Availability and cost of local food resources sold in many co-op and other commercial outlets should also be taken into account, when estimating food costs for northern residents living in different circumstances. Such data were not asked for and therefore not included in the 1974 and 1979 surveys.

Periodical updating perhaps every three to five years is necessary to reflect ongoing changes in availability and cost of food in various northern settlements.

The 1979 survey perhaps because of a wider representation of small and remote communities particularly in the Central and High Arctic, poorly represented in the 1974 food distribution survey, impresses one as much if not more with the severe restriction of availability

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* Only first page each of vitamin C supplying food servings from Ft. Smith, Keewatin and Baffin Region are copied as examples from the 170 page report containing more than 150 pages of tables!

TABLE XIV[a]

FOOD AVAILABILITY

Category	# Items Listed	Inuvik[b]		Norman Wells	Tuktoyaktuk
Dairy/Eggs	8	8	8	8	5
Cereals/Bakery	9	9	8	7	8
Meat -Fresh	7	7	7	5	4
Meat -Processed	11	10	7	6	9
Fruit/Vegetables -Fresh	7	6	7	7	7
Fruit/Vegetables -Processed	15	15	13	14	13
Fats and Oils	6	6	6	5	6
Miscellaneous	23	23	23	18	21
Total	86	84	79	70	73

[a] From Stiles and McLean (1974, 1977). See reference #69.
[b] For localities where two or more grocery stores were surveyed such as Inuvik, Frobisher, Yellowknife and Rankin Inlet two or more columns are listed.

and/or horrendous cost of many food items regarded as essential by other Canadians in most small and remote settlements of the Northwest Territories and there is no indication that the situation has improved at all in these five years. These tables need to be studied in detail by agencies concerned with food marketing with an aim to increase availability and choice of various food items in the Northwest Territories.

Some cautionary remarks may, however, be appropriate in order to avoid use of these tables to support some popular but false claims.

Non-availability or much higher cost of many of the imported food items listed in either Professor Stiles' survey of 1974 or the 1979 survey of the N.W.T. Nutrition Liaison Committee in such places as Pelly Bay, Trout Lake or Lac La Martre does not necessarily mean that meals prepared in these remote localities are that much more deficient in nutritional value or that much more expensive than at Edmonton or Hay River. Availability and cost of local food resources and their nutrient content must be taken into consideration.

When this is done it becomes evident that, indeed, as far as protein and a number of other nutrients are concerned nutritional requirements are or could amply be met from local resources at quite low costs and that therefore non-availability of fresh eggs, and fresh pork, chicken and beef are not putting local people at any nutritional risk nor do high prices for import of such items necessarily increase their cost of living.

In regard to fresh fruits and vegetables, we must, however, in our day and age take a different view. Although traditional Dene and Inuit diets did not need any supplementation by such imports, encouragement should be now given to strengthen or reawaken greater use of berries and native plants as well as to the introduction of local horticulture or hydroponic growing of vegetables. We realize that imported fresh fruits and vegetables present not only a pleasant and increasingly enjoyed enrichment of northern diets, but have become a nutritional necessity supplying vitamin C, folates, carotene, and a number of trace elements, most of which were rather marginal in traditional northern diets and therefore first in need of supplementation in mixed transitional diets. A similar case can be made for dairy products, in particular cheese, as a rich source for calcium, which is notoriously undersupplied in meat eaters unless they chew fish and spongious bones.

TABLE XV[a]

FOOD AVAILABILITY

Category	# Items Listed	Frobisher Bay		Pangnirtung	Resolute Bay
Dairy/Eggs	8	7	4	6	3
Cereals/Bakery	9	7	1	7	3
Meat -Fresh	7	6	4	5	5
Meat -Processed	11	9	4	9	7
Fruit/Vegetables -Fresh	7	7	6	7	6
Fruit/Vegetables -Processed	15	14	3	12	7
Fats and Oils	6	6	2	5	4
Miscellaneous	23	23	9	23	16
Total	86	79	33	74	51

[a] From Stiles and McLean (1974, 1977). See reference #69.

TABLE XVI[a]

FOOD AVAILABILITY

Category	# Items Listed	Yellowknife				Rae	Snowdrift	Coppermine	Cambridge Bay	Wrigley	Rankin Inlet		Baker Lake
Dairy/Eggs	8	8	8	8	8	3	4	8	4	5	3	6	6
Cereals/Bakery	9	6	8	7	8	6	6	7	5	9	3	8	8
Meat -Fresh	7	7	7	6	7	3	0	0	7	4	0	5	2
Meat -Processed	11	11	11	9	7	7	6	9	6	8	0	9	9
Fruit/Vegetables -Fresh	7	7	7	7	7	7	0	7	7	6	0	7	2
Fruit/Vegetables -Processed	15	15	15	15	14	10	13	14	10	13	0	12	14
Fats and Oils	6	6	6	6	5	3	2	6	5	5	2	6	6
Miscellaneous	23	22	23	23	23	11	21	22	16	21	7	22	23
Total	86	82	85	81	79	50	52	73	60	71	15	75	70

[a] From Stiles and McLean (1974, 1977). See reference #69.

TABLE XVII

AVAILABILITY, COST AND NUTRITIONAL VALUE OF IMPORTED FOODS FORT SMITH REGION (WINTER 1978/79)

Product	Serving Size[a]	Nutrient Contribution /Serving	Cost/Serving and Availability										
			Fort Liard (Hudson's Bay)	Gjoa Haven	Hay River (Godwin's)	Fort Smith (Hudson's Bay)	Coppermine	Spence Bay	Trout Lake	Nahanni Butte	Pelly Bay	Lac La Martre	Average
Vitamin C													
Milk, fresh homo	250 ml	2 mg	.31	N/A	.16	.18	.44	N/A	N/A	N/A	N/A	.40	
Trimilk (83 mL undiluted)	250 ml	2 mg	N/A	.28 (winter)	.10	.11	.19	.27	N/A	N/A	N/A	N/A	
Evaporated milk, whole (undiluted)	250 ml	35 mg	O/S	.45	.34	.38	.42	.46	O/S	.44	N/A	.62	
Powdered skim milk	250 mL (25 ml powder)	1 mg	.10	.10	.09	.09	.09	.06	O/S	.07	N/A	.07	
Dry, whole milk	250 mL (25 ml powder)	1.7 mg	.15	.17	N/A	N/A	.25	.18	N/A	N/A	.37	N/A	
Oranges, fresh	1 orange (180 g)	66 mg	.33 (weekly)	.79 each	.27	O/S	.45	.80	.25 each	.30 each	N/A	.40 each	
Potatoes, baked	100 g	20 mg	O/S	.22	.04	.03	.13	.23	.07	.10	N/A	O/S	
Potatoes, cooked with peel	100 g	22 mg	O/S	.22	.04	.03	.13	.23	.07	.10	N/A	O/S	
Potatoes, cooked without peel	100 g	20 mg	O/S	.22	.04	.03	.13	.23	.07	.10	N/A	O/S	
Cabbage, raw	74 g	44 mg	.14	.29	.07	O/S	.23	N/A	N/A	N/A	Perishable every two months	.03	
Green Pepper, raw	74 g	94 mg	O/S	.29	.22	O/S	.32 (occas)	O/S	N/A	N/A		N/A	

[a] Suggested by Canada Food Guide.

*From N.W.T. Nutrition Laison Committee Survey (1979). See ref. #43.

Key: N/A = Not Available
O/S = Out of Stock

TABLE XVIII

AVAILABILITY, COST AND NUTRITIONAL VALUE OF IMPORTED FOODS
BAFFIN REGION (WINTER 1978/79)

Product	Serving Size[a]	Nutrient Contribution /Serving	Cost/Serving and Availability								
			Pond Inlet (Hudson's Bay)	Pond Inlet (Co-op)	Resolute Bay	Nanisivik	Pangnirtung	Broughton	Lake Harbour	Unknown	Cape Dorset	Average
Vitamin C												
Milk, fresh homo	250 ml	2 mg	.70	N/A	N/A	.56	.71	N/A	O/S	O/S	.68	
Trimilk (83 mL undiluted)	250 ml	2 mg	N/A	N/A	.24	N/A	N/A	N/A	N/A	N/A	N/A	
Evaporated milk, whole (undiluted)	250 ml	35 mg	.43	.43	.67	.43	.43	.43	.42	.36	.44	
Powdered skim milk	250 mL (25 ml powder)	1 mg	.07	.09	.17	N/A	.06	.06	N/A	.06	.10	
Dry, whole milk	250 mL (25 ml powder)	1.7 mg	N/A	N/A	.17	.17	.17	.36	.17	.14	.17	
Oranges, fresh	1 orange (180 g)	66 mg	N/A	.60 each	.45 each	.45 each	.69 each	60-1.00 each	.40 each	.38 each	.49 each	
Potatoes, baked	100 g	20 mg	.33	.34	.18	.18	.22	.24	N/A	.10	.20	
Potatoes, cooked with peel	100 g	22 mg	.33	.34	.18	.18	.22	.24	N/A	.10	.20	
Potatoes, cooked without peel	100 g	20 mg	.33	.34	.18	.18	.22	.24	N/A	.10	.20	
Cabbage, raw	74 g	44 mg	N/A	O/S	N/A	.22	.21	N/A	N/A	2.09 each	N/A	
Green Pepper, raw	74 g	94 mg	N/A	O/S	O/S	.69	.16	rarely	N/A	.95 each	N/A	

[a] Suggested by Canada Food Guide.

From N.W.T. Nutrition Liaison Committee Survey (1979). See reference #43.

Key: N/A = Not Available
O/S = Out of Stock

TABLE XIX

AVAILABILITY, COST AND NUTRITIONAL VALUE OF IMPORTED FOODS

KEEWATIN REGION (WINTER 1978/79)

Product	Serving Size[a]	Nutrient Contribution /Serving	Cost/Serving and Availability						
			Rankin Inlet (Hudson's Bay)	Coral Harbour	Baker Lake	Repulse Bay (Co-op)	Whale Cove	Eskimo Point	Average
Vitamin C									
Milk, fresh homo	250 ml	2 mg	.40	O/S	O/S	N/A	N/A	O/S	
Trimilk (83 mL undiluted)	250 ml	2 mg	N/A	N/A	N/A	N/A	N/A	N/A	
Evaporated milk, whole (undiluted)	250 ml	35 mg	N/A	.49	.36	.36	N/A	44	
Powdered skim milk	250 mL (25 ml powder)	1 mg	.09	O/S	N/A	.06	N/A	.10	
Dry, whole milk	250 mL (25 ml powder)	1.7 mg	.16	N/A	.16	N/A	.18	.15	
Oranges, fresh	1 orange (180 g)	66 mg	.37 (each)	O/S	.60 (each)	.49 (each)	.60 (each)	N/A	O/S
Potatoes, baked	100 g	20 mg	.11	O/S	.16	.13	.23	N/A	O/S
Potatoes, cooked with peel	100 g	22 mg	.11		.16	.13	.23	N/A	O/S
Potatoes, cooked without peel	100 g	20 mg	.11	O/S	.16	.13	.23	N/A	O/S
Cabbage, raw	74 g	44 mg	.10	O/S	.22	.18	.24	N/A	.13
Green Pepper, raw	74 g	94 mg	.64 (each)	O/S	.30	.33	1.00 (each)	N/A	.63 (each)

[a] Suggested by Canada Food Guide.

From N.W.T. Nutrition Liaison Committee Survey (1979). See reference #43. ref. #43.

Key: N/A = Not Available
O/S = Out of Stock

Recommendations to Enhance the Use of Local Food Resources

Chapter II illustrated that deviation from traditional nutrition habits led to deterioration of nutritional health and to the appearance or increase of so-called "civilization" diseases in both Indians and Inuit.

Chapter III demonstrated the superb nutritional value of traditional native eating habits and local food resources and we discussed present availability of such resources.

The recommendations following in this chapter relate primarily to the nutritional health of those Inuit, Dene and other residents of the Northwest Territories who still derive or could conceivably derive in future substantial proportions of their nutritional requirements from local food resources, while recommendations towards ensuring optimal nutrition at reasonable cost for all Northwest Territories residents will be discussed by Dr. Jean Steckle, the Consultant for Nutrition of Medical Services Branch, Health and Welfare Canada, in the final chapter.

The following programs to be undertaken by various territorial and federal agencies are deemed useful and necessary to enhance greater use of native foods:

1. Education programs, emphasizing the nutritional value of native food resources and traditional nutrition habits, should be developed or if existing, be reinforced. These should be aimed at both children and adults to counteract the adverse trends experienced to date. The education program should not limit itself to theoretical teaching but also include practical demonstrations such as berry picking expeditions for school children, cooking lessons for adolescent girls and women, hunting and game cleaning demonstrations for adolescents and young adults of both sexes.

2. Territorial agencies such as the Territorial Wildlife Service and the Department of Economic Development and Tourism perhaps assisted by federal authorities should initiate a **program of stimulating, facilitating and organizing systematic harvesting, storage, distribution and marketing in northern communities of native food resources.** This should begin with seals, the carcasses of which are now being wasted and for which greater exploitation is regarded as permissible by wildlife management personnel. It implies organization of local hunters' co-operatives employing young and middle-aged hunters on a regular basis with a modest basic wage plus individual incentives according to the game contributed. (This is the basic scheme of native hunters' "colchoses" in the U.S.S.R., which supply a major proportion of protein requirements for a relatively large population including many non-native newcomers.)[42]

Successful operation of such a scheme would also hinge upon initial government involvement to ensure storage facilities, supervision of cleaning and packaging of products, shipping, and marketing in selected northern communities where there is want and need for such food.

The qualifications of seal meat for such a program are impressive. Not only is much of it at present being wasted, and not only are seals readily available in good supply but they are also the richest sources of protein, iron, unsaturated long-chain fatty acids (which counteract elevation of blood cholesterol and triglyceride levels) and a number of other essential vitamins and minerals.

Unfortunate publicity, including inaccurate, exaggerated and misleading statements in the media about mercury levels found in sea mammals and in Inuit hair have contributed to the trend of diminished consumption of seal meat and organs by Inuit. This has also raised moral questions in the minds of many concerned agency officials as to the advisability of embarking on schemes to encourage greater consumption of sea mammals, while warnings are being issued by government agencies against more than occasional consumption of such food; and when commercial enterprises such as the muktuk cannery at Rankin Inlet have been shut down, albeit without sound reasoning.

Epidemiological and experimental research conducted by ourselves and others[16,26,33,83,85] failed to find any clinical or morphological evidence of mercury toxicity from consumption of seal meat and liver in much larger amounts than used in recent or even historical times; and there is ample evidence that mercury concentration in Arctic water and in sea life have been essentially unchanged since ancient times when sea mammal consumption by Inuit was manifold that of today!

There is increasing evidence from above-quoted and other sources that total mercury content alone does not provide useful guidelines as its absorption, transfer and action on various cell structures and organs vary greatly with organic binding and is greatly modified by other elements such as selenium — present in equimolar concentration in seal organs[86].

These recent research results all tend to confirm the common sense reaction of most older Inuit, who were upset by premature warnings issued in recent years against consumption of sea mammals, namely:

"The seals always ate what they eat now so what makes you think they got something that they did not always have. And if that did not harm our parents, who ate many more seals than we do, how could it harm us?" (Personal communications with Baffin Zone Inuit, also similarly expressed in Intra-departmental Memos by Zone Director, Keewatin in early and mid 1970s).

We may therefore conclude: Experimental and epidemiological research during the last decade, as well as long-term experience and convictions of the Inuit contradict premature assumptions that mercury in seal meat and liver would constitute a potential health hazard to those persons and communities envisaged as a likely market for harvested surplus seal, as they never could buy and consume quantities even approaching the amounts which are eaten at present without untoward consequences in many other communities, to say nothing of the amounts eaten by their forefathers.

Assistance for organization of fish co-operatives and caribou hunting, including organization and transport of hunting parties as well as intercommunity exchange of caribou meat and fish have been given in the past, and this should probably continue in limited scale as local stocks allow. But any significant increase in scale of these activities appears unlikely.

Acting on information gathered and recommendations offered by local physicians and nurses or periodical on the spot surveys by Medical Services personnel[9,30,40,44,50,53,55] or other researchers and consultants[4,6,20,29,41,42,45,48,73], Medical Services have taken the first steps to monitor at appropriate intervals, groups identified or suspected at particular risk for nutritional deficiencies, and have put into action individual or risk-group oriented supplementation programs, in most cases concerning iron and vitamin medication, but in a few cases, other nutrient supplementation as well.

A further increase of these activities is likely to be necessary, especially in settlements most affected by changes in occupation and lifestyle and thus, nutritional habits.

Lifestyle and social health are intimately connected with, and have profound effects on, nutritional and general health, especially in populations in transition as was clearly demonstrated in our 1977 Inuvik survey[53]. Therefore a final comment may not be out of place in regard to the expected social effects of the above scheme, for systematic harvesting of native food resources[82].

In the traditional hunting societies of Inuit and Northern Indians the men were the foremost meat providers; and the very existence of the extended family depended on the initiative, skill and success of the hunter. Therefore these traits rank highest in value consciousness of men of such societies, and their status grows with their ability to provide well for their family and to be able to offer meat to older persons and neighboring families in need[84].

Increasing opportunities to fulfill such roles as the providers of meat and basic sustenance, while at the same time providing the means to give some economic security would help to restore self-esteem and dignity to a substantial proportion of young and middle-aged native men. This may help to stem their efflux from smaller settlements and outlying camps into larger centres where the majority of them do not find meaningful work and so become dispirited by idleness and frustration, or feel degraded by the receipt of welfare handouts or by doing menial chores and being subordinated to strangers. Then they seek relief in alcohol which, after a fleeting restoration of the feeling of power, prowess and self-confidence, often plunges them into violent outbursts of pent-up hostility and suicidal despair.

We have seen these developments in Inuvik, Frobisher, Cambridge Bay and Rankin Inlet. Alcohol is involved in the majority of cases of death due to accidents, poisoning and violence, by far the leading cause of death for natives in the Yukon and Northwest Territories in recent years and directly or indirectly involved in a major proportion of physical, mental and social illness in the North.

We do not claim that the proposed scheme would remove all or even the majority of causes of the vicious circle of social, mental and physical ill health. But it would be a giant step in the direction of improved nutritional health, economic self-sufficiency and increased social and cultural well-being, particularly of Inuit and Dene, but to some degree of all residents of the Northwest Territories.

An intradepartmental memo dated March, 1972 entitled "Improvement of nutritional status of northern native populations by government assisted programs for commercial harvesting and distribution of native food resources", which relates in particular to information re such schemes gathered in the U.S.S.R.[82], is attached as Appendix A.

Recommendations Towards Ensuring Optimal Nutrition at Reasonable Cost for All Residents of the Northwest Territories

Conservation of food resources was the basic philosophy of all traditional societies, including the Inuit. The early history of the Inuit described in this paper illustrates the ability of man to adapt to his environment and utilize and conserve local food resources for optimum health. Modern society needs to review these principles and not allow waste and convenience to overshadow conservation. It is recommended that the Northwest Territories introduce food policies based on conservation principles. Cost is one factor in developing a satisfactory food system; equally important are availability, nutritive value, processing and conservation skills, taste and preference. Today, when southerners as well as northern native Canadians look forward to long-term residence and a modern lifestyle in the North, is the time to develop an appropriate northern food system.

PROBLEMS IN THE NORTHERN FOOD SYSTEM

Subsidies have been important in promoting acculturation of the North including the provision of such essential services as education, health care and administration. Annual food rations were provided to civil servants in the early days. As the northern infrastructure developed indexing of salaries was introduced based on the cost of living, including the cost of food. For the native population, parity was introduced by indexing social assistance and unemployment insurance. The result was a phenomenal demand for southern processed food and many native Canadians shifted their dependence from land food to store foods. Subsidies are still an essential consideration, however their impact needs to be evaluated in relation to long-term development. Different subsidies have different effects. Transport subsidies have been hidden; roads and airstrips have been built in isolated communities at little cost to the community or the territory. The food distribution services have been indirectly subsidized. The cost of providing commercial distribution and storage (stores) for food are paid for directly by the consumer, but inevitably this affects parity and indexing structures. The cost of subsidies, visible or hidden is a serious consideration in the development of a modern food system in northern Canada. As the population increases in the North, dependency will give way increasingly to self-reliance.

Another problem relates to the availability of fresh food and produce, both from the land and imported from the South. Fresh food from the land is a renewable resource of great value in the North. Its availability depends on the season, the region where each species flourishes, opportunities for exchange between regions and the natural cycle of good years and bad. Traditional practices of harvesting, storage and distribution need to be modernized and integrated into the modernized lifestyles of the North. Even though supplies of land food and fish may be limited they will provide a valuable portion of the fresh food required for variety and good health. Imported fresh produce has been difficult to obtain and distribute in small isolated northern settlements. Fresh milk, bread, meat and vegetables have a limited shelf life and require specialized rapid transport methods and special storage systems.

The cost of importing fresh food is directly related to the cost of the infrastructure required to transport, hold, transfer and distribute perishable foods. At the best of times quality control will be difficult to monitor and in many instances the nutritive value will not warrant the cost. Attempts to import and control "best before date" food products can only lead to dissatisfaction and a cost-spreading effect which is unacceptable in maintaining the reasonable cost of all food items in the food basket. Only a limited number of food items can be justified in this category. Other ways to prepare convenient, tasty, fresh food in the community need to be explored. Bread, other baked goods, and reconstituted milk could be processed locally using traditional Canadian technology. New technology is available in Canada and could be used to develop cooperative food processing or the germination of seeds for vitamin-rich sprouts. New solar-technology is also available to maximize the use of the Arctic sun either for food production or processing. Arctic cold storage technology holds promise for modernization and adaptation to the evolution of a food system.

The small market in low population areas is another factor in conflict with "economies of scale" practiced in southern Canada. The needs of the small community are different and need to be planned to interface and take advantage of southern systems. Co-operatives lend themselves to this type of market and take into account local preferences for food stuffs.

The problems that exist today include the cost of developing and maintaining a food distribution infrastructure; the development of food resources to ensure good nutrition, variety and year-round availability and the modernization of a marketing system to supply food at reasonable cost in low population areas. Modern and traditional technology are both appropriate to the rapidly changing social scene and offer opportunities for those intending to participate in the modernization of the North.

METHODS TO IMPLEMENT CHANGE AND DEVELOP A NORTHERN FOOD SYSTEM

A number of suggestions were put forward to improve nutrition and the availability of food at reasonable cost during the Baker Lake Nutrition Workshop, sponsored by Medical Services Branch, 1977[27]. These suggestions included education, land food exchange, better use of store foods and improved infant feeding. In addition attention is given to man's talent, energy and effort in the development of productive employment opportunities, appropriate to the North. Year-round access to a nutritious diet at reasonable cost needs talent, as well as capital investment. A reliable supply of raw food stuffs is also essential. The creditibility gap between the knowledge and talent of the southern professional accustomed to economic affluence and waste and the northern resident who has been brought up on principles of conservation requires concerted effort to co-operate in planning a modern food system for the North.

EDUCATION

No single lifestyle can adequately describe all people in the North. Different values are associated with different lifestyles. Through education an appreciation for different values related to different lifestyles can be developed. This type of education will help young people make decisions and choose a lifestyle with confidence. Confidence allows young people to move comfortably in the community and take community responsibility, including community responsibility for the food system. The environmental studies program currently being developed and tested by the Territorial Government is to be encouraged as it can prepare young people for their role in the modern northern society. Within this educational framework, a choice of lifestyle can be selected whether it relates to the use of land foods or imported foods or some of both. This type of education is a long-term venture. There are also short-term solutions related to adult education and public education. These programs need to be further promoted through both Territorial and Federal Government agencies. Nutrition education aims to improve the knowledge and practice of residents in the best use of available foods. Essential nutrients are available from many different resources; for example, vitamin C is available from either oranges or fresh seal liver. Good food and exercise habits are best learned early in life at home, reinforced by the school. The dialogue between parents and teachers can be developed through concrete programs. The school lunch program is an example of where parents and teachers can work together. Equally important is education through women's groups, encouraged through the home management program. The public health centre is a focus for health education and needs to continue to provide knowledge and information at the time it is most needed; for example nutrition is pertinent to expectant mothers and can benefit mothers of infants and young children.

BETTER USE OF STORE FOODS

Concern for the widespread use of low-nutrient density foods (junk food) in northern settlements prompted the community health representatives to make representation to the Hudson's Bay Company stores and the Federated Co-operatives stores throughout the Territories. Their recommendations, which went through various channels, led the Hudson's Bay Company to employ a nutritionist and launch the upgrading of their store food program. The program includes shelf labelling on the nutritive value of foods displayed, education on the selection of foods, using posters and store demonstrations and the introduction of better quality snack foods, such as nuts and fruit. The pilot nutrition project launched in the summer of 1978 was evaluated[28]. Plans to extend it to other communities need to be encouraged. Further plans to hold store demonstrations on the use of low-cost high-nutrient foods also deserve support in co-operation with the home management education program of the Territorial Government. This program is important for all consumers but particularly for women's groups in the settlements. Educational displays in the nursing stations can support the education program.

LAND FOOD EXCHANGE

The game food species native to the North are very unevenly distributed, particularly in relationship to current centres of population. In nomadic times it was possible to move and take advantage of different foods available seasonally. With settlement life, a system of land food exchange is being proposed by the hunters and trappers. Several pilot schemes have been conducted and early in 1978 the Government of the Northwest Territories adopted a program which could serve as the beginning of a long-term commitment for the use of renewable food resources. The purpose is primarily to improve the nutritional status of local residents with food that is locally available. This program needs to be encouraged. A meeting was convened by the territorial government of federal and territorial officials to review methods to benefit both hunters and consumers. It was felt that considerable attention would need to be given to a spectrum of factors affecting a viable food exchange system.

These included:

- an inventory of available harvest resources.
- local involvement to monitor and conserve wildlife harvest.
- improved technology to overcome waste in harvesting, processing and storage.
- improved health standards in the handling, cutting and storage of game and fish appropriate to northern conditions.
- anticipation of food needs and preferences to maintain regular supplies.
- development of research methods appropriate to monitor contaminants, if any, in land food.
- public education on research relevant to land food use including nutritive value and safety.

There appears to be a great gap between the beliefs of local people and the southern professionals concerning land food. Both groups have a great deal to learn from each other to resolve land food utilization methods. Urgent attention is required to effectively support land food exchange and modernize traditional conservation methods.

IMPORTED FOOD AND CONVENIENCE FOOD

With growing population in the North much more attention needs to be given to employment opportunities for women and young people, particularly to develop a local food service industry. A local food service industry could provide fresh, tasty, convenience foods. This would overcome the problem of importing supplies of overpackaged foods, "best before date" products prepared for an expensive southern urban market. Larger centres in the North may be able to support a "cottage industry" of specialized shops while smaller centres may choose a multipurpose cooperative food processing and preparation centre. The school kitchen could serve as a planning and testing centre to develop this type of infrastructure in the North. Government financing of such projects needs to be encouraged in the economic growth sector. Bread and bakery products, milk and milk products, and food prepared from canned, frozen, dried or fresh meat, fish and vegetables deserve urgent attention.

INFANT FEEDING

Human breast milk is the most valuable food resource for infants. Research has shown that children who are breast-fed grow better and have a much better chance of being healthy. Breast-feeding needs to be encouraged through the health centres. A climate which favors breast-feeding should be evident in all hospitals used by northern residents. Procedures on maternity and nursery wards should be reviewed to weed out any practices encouraging early introduction of formula-feeding such as free distribution (Brand Name) formula, starter packages or giving to breast-fed infants in the nursery, supplementary glucose or formula bottles between breast-feeding times.

Professional guidelines on infant feeding which have been developed[31] need to be implemented to make optimum use of locally available food stuffs and meet changing cultural values. Jobs employing women in the North should allow mothers to breast-feed their children by establishing appropriate local arrangements.

SUMMARY

A reliable food supply for a growing population in northern Canada is fraught with problems that are unique to northern Canada. Particular attention is required to develop an appropriate infrastructure to serve isolated northern settlements with a minimum of subsidization. Hidden subsidies can build a false infrastructure. On the other hand, a sound infrastructure:

- provides for optimum use of food resources, both local game and sea foods and foods imported from the South.
- develops educational and technological systems to support local employment policies which control and direct the food system within the North.
- improves education and technology through research to promote an economical choice of nutritious tasty food appropriate to northern lifestyles.

The principles of conservation, inherent in traditional society, need to be reviewed in the modernization of a northern food system.

Appendix A

Intra-departmental memo, Medical Services, March 1972[22].

Improvement of nutritional status of Northern native populations by Government assisted programs for commercial harvesting and distribution of native food resources.

Medical Services have in recent years become increasingly aware of the important role nutritional factors play in the total health picture of our native population. This was illustrated and discussed in some detail in several previous memoranda.

During a recent trip to Moscow arranged by the Advisory Committee on Northern Development one of the main areas defined as of common interest to health authorities and medical researchers concerned with medical problems in Northern areas and native populations in Canada and the U.S.S.R. concerned nutrition problems.

I was told of the existence and allegedly very successful operation of "Hunter's Colchoses" in various Soviet Republics or autonomous regions in the Northern Regions of the U.S.S.R., wherever substantial proportions of the local population — and this concerns particularly those of native stock — depend on trapping, hunting, fishing or reindeer herding for a living. State authorities have naturally had a hand in the organization of these colchoses and they continue to give direction according to scientific advice for professional harvesting of local meat and fur resources, as well as for distribution of marketing and remuneration of hunters and trappers. This is claimed to protect them from excessive natural or market fluctuations and to make their cash and other benefits comparable to that of industrial or agricultural workers.

They credit this system with having resulted in —

a) improved utilization and avoidance of wastage of local resources.

b) securing a good nutritional base in the most economical way.

c) making it possible for people remaining in their original habitat even in remote areas to participate in the improving living and cultural standards of other Soviet citizens securing their material basis with attractive incomes.

I suspect that this rosy description may have been a bit colored by the state dictated optimism, obvious in all public pronouncements and publications. But in principle this system and above points make real sense and if adapted to a form more acceptable to our political and economical system in the sense of the proposals, page 6 and 7 of my May 1970 memo, may truly help to improve physical and mental health in the Canadian North. This may counteract the sequence of events commonly seen when former hunting peoples are acculturated, which is only too obvious in our Indian and Eskimo population, at present, namely:

1) Their nutritional status suffers when switching from the native meat diet to imported food largely consisting of cheap food staples such as flour and sugar.

2) They become unemployed or due to lack of opportunity or training are relegated to menial tasks only, thus resulting in idleness and frustration.

3) The resulting personal and social degradation lead to increased vulnerability to the often also then for the first time in greater quantity and frequency available alcohol.

One cannot exaggerate the importance of any action apt to ameliorate this sequence of social and medical ills for our Northern native population as in both Yukon and N.W.T. the leading cause of death and a major part of diseases treated at tremendous costs are related to the above enumerated points. Our department has, therefore, in my opinion, an obligation to explore ways and means which may bring about an improvement in the medical situation.

If causes of physical and mental diseases are found to be rooted in the social sphere falling into the realm of another department, as appears to be the case in regard to the above discussed points, we should not hesitate to draw to the attention of that department the importance we attach to the problem and seek a solution in co-operation with them.

In the following I shall discuss in detail an existing situation in one region of the Canadian North (Baffin Island) and possible steps to improve the situation. For other areas this practical example would have to be modified:

I have for years talked (in community meetings, in talks to nurses, doctors, teachers, administrators) and written about the value of native foods, of which seal meat

is according to various analyses the most valuable, still most plentiful and indeed at present most frequently wasted resource.

I was, therefore, very thrilled, when I learned in April 1970 in Frobisher that Mr. J. Haining, the Chief Industrial Development officer for the Baffin Region, had started to put in effect a scheme to prevent the wastage of seal meat seen all over the Arctic since the replacement of dogs by skidoos and at the same time to make seal meat available in Frobisher where there is a need and desire for it. This I hoped would be the beginning of the creation of a native meat harvesting industry as discussed in previous memos. Much has been done on Regional and Zone levels to make our doctors, nurses, community health workers and through them the population at large aware of the nutritional value of native food resources and feeding practices and to encourage their continued use with slight modifications whenever indicated by specific parasitic or other (Botulism) dangers. Teaching of the value of native food resources should also become part of health and general education in schools in the North and in schools across the country, attended by a majority of native students. I was disappointed to learn in Frobisher at the beginning of this month (March 1972) that not much progress has been made so far in regard to the creation of a native meat harvesting industry. I was told of a "community food exchange program", which however deals mainly with Arctic char (which due to popular demand by Whites in Northern and Southern Canada has become fairly highly priced luxury food and appears to be a slowly replenishable and, therefore, in many areas already sharply diminishing food resource), and with "Muktuk" (i.e. the skin of white and nar-whales) an at all times cherished delicacy (rich in glyco-proteins) of Eskimos, which is similar as fish inferior to meat as a source of iron and a number of other minerals. Seal meat, however, was not made available by the "community food exchange program" for more than a year now, i.e. not at all this winter and only once last winter according to a number of Eskimos with whom I talked. These Eskimos stressed how much they still like the taste and are aware of the value of seal meat which they prefer to beef and pork, sold at nearly $2.00 per lb. even for less inferior cuts. T'ıis is a very regrettable situation for the following reasons:

a) Seal meat was the single most important food resource for Eastern Arctic Eskimos and there is still a popular demand and taste preference expressed for it. This, however, is likely to wane if by lack of familiarity its taste and smell is felt to be strange and eventually obnoxious, as most Whites and now some of the younger Eskimos especially those who spent several years "outside" in schools, hospitals, etc. regard it.

b) Seal meat is in regard to nutritional value superior to all other food resources in the Arctic, in some respects even to caribou meat.

c) Greater use of seal meat is unlikely to result in depletion of this resource as at present thousands of seal carcasses are wasted annually in Baffin Island alone due to increased hunting and netting solely for skins and decreased demand for dogfood. No serious depletion of the seal population has so far been noticed except near larger population centres such as Frobisher Bay. By organizing proper preservation and marketing of the meat, which has in recent years become an often wasted by-product of the fickle fur trade (as the obnoxious sight and stench of hundreds of rotting skinned seal carcasses on the beaches of Pangnirtung, Broughton Island and other communities near rich sealing grounds the last three summers attest), hunters would receive more cash return from sale of meat than from skins and would not need to get such excessive numbers for comparable or better and less fluctuating earnings.

In contrast Arctic char and caribou are under increasing fishing and hunting pressure and in danger of serious depletion.

This is, in my opinion, a correctable situation if the following steps are taken:

1. Medical Services must continue and increase its education efforts of their own personnel and through them of the public at large, native as well as non-native, living in the North, in regard to stressing the superior nutritive value of seal meat. We also should seek a greater influence on content and persons entrusted with health education in schools.

2. A reasonable but nevertheless marked increase of prices paid to Eskimo hunters for seal meat should be sponsored by Industrial Development of the Territorial Government.

3. The same government agency should care for proper local storage and preservation (larger community freezer units?) and cheaper means of transportation and marketing on a planned and regular basis.

4. The initial marketing should be sponsored by Government rather than private agencies until it is established if an attractive retail profit can be born by this, to the health and social development of our Northern native population vital meat harvesting industry.

If necessary, subsidies to keep such an industry going would be amply justified by social and health benefits derived from it and would be more than compensated by savings in welfare and health care delivery costs.

The price of $0.05 per lb. of butchered, cleaned and cut fresh seal meat delivered at landing strips (as paid 1970 in Broughton Island) is ridicu-lously low and may contribute to "cheapen" the regard for seal meat in the eyes of the Eskimos. A higher price paid per pound and facilities to store and preserve (freezer units) and a planned and on a regular basis functioning distribution and marketing system are necessary to eliminate the at present horribly increasing waste of this single most important and valuable native food resource of coastal Eskimos, and to create a healthy industry supplementing and eventually superseating the unpredictable and fickle fur industry. Such industry and source of cash-earning employment is desperately needed for the increasing numbers of idle and frustrated young Eskimo males hanging around in practically all settlements. There is no more gratifying activity in the mind of the Eskimos and other hunting societies than for a man to be a successful meat provider for others.

I was told that seal meat marketing in contrast to gourmet food such as Arctic char and muktuk would not tolerate the high transportation costs and, therefore, fell behind other food items in the community food exchange program.

I am inclined to disagree with this assessment, after talking to more than a dozen individual Eskimos in Frobisher, housewives, and men of all age groups, who all assured me that they a) preferred seal meat to beef and pork, b) were willing to pay in excess of 50 cents or even one dollar (1972) per pound for it.

One completely unexpected result of my private opinion survey regarding a fair price level for seal meat sold in Frobisher was the fact that younger men generally indicated to me a higher price level than older people as a fair exchange for seal meat, although there was no doubt that the older people had greater desire for it and missed it more. This unexpected reversed subjective price relation may, however, only reflect a different attitude to money in the different generations and the memory of the times when these older Eskimos got 10 cents a pound for seal meat, e.g. paid by St. Luke's Hospital in Pangnirtung. When I reminded them that poor cuts of beef and pork cost nearly $2.00 per pound in Frobisher, they admitted that seal meat was pound for pound giving much better nourishment and tasted better. The cautions older Eskimos and housewives added, however, that eating pork and beef remained for them a rare exception, but if seal meat would go that high they would not be able to afford to eat it as often as they would like.

In summary: Nutritional changes have been proven to affect very profoundly the general health status including normal development, resistance to infections, a series of diseases typical for modern man.

Former hunting peoples appear to be particularly sensitive to such changes. Canadian Eskimos are perhaps an extreme example for this general rule due to past and recent history.

To lessen the nutritional impact of recent developments and improve the physical, social and mental health of native peoples in the North a scheme of systematic meat harvesting is proposed to be at first encouraged, organized, sponsored and if necessary, even subsidized, by Territorial and Federal Government agencies.

Soviet authorities claim to have created organizations which efficiently provide for proper meat, fur and fish harvesting to the nutritional and social benefit of their peoples, who form the back-bone of such "Hunter's Colchoses." A different name and different methods would have to be devised to be acceptable to our structure of society and government, but surely there must be a better way than the present inexcusable waste of the best food resources in the North and the consequent disastrous effects on physical, social and mental health of our Northern native peoples.

Baffin Region, perhaps would be the best area to start a pilot programme which, however, in modified forms may be applicable to other areas and native population groups within and beyond the borders of the N.W.T.

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Biographies

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Born 2 October 1919 in Betzdorf Sieg, West Germany Otto Schaefer studied medicine at the University of Heidelberg graduating in medicine in 1944, his dissertation for doctor *medicine* was accepted at Heidelberg in 1945.

Emigrating to Canada in the summer of 1951, Otto Schaefer worked as a farm labourer and attendant in a mental hospital before qualifying as a medical intern at the Royal Alexandra Hospital in Edmonton in November 1951. He sat for LMCC examinations in the summer of 1952 and took up duties at the Charles Camsell Indian Hospital in Edmonton in November 1952. He started his long career into northern medicine in January 1953 when he was transferred to Aklavik, Northwest Territories. He served two years each in the Western Arctic, Eastern Arctic and Yukon Territory before returning to Edmonton to pursue post-graduate studies at the University and Charles Camsell Hospitals qualifying as a Specialist in Internal Medicine in 1963. In 1964 he was placed in charge of the Northern Medical Research Unit based at the Charles Camsell Hospital.

Otto Schaefer became a Fellow of the American College of Physicians in 1965 and in 1972 a Fellow of the Canadian College. He was appointed Honorary Associate Professor of Medicine at the University of Alberta in July 1975. In 1976 Otto Schaefer, was named a member in the Order of Canada.

His research over the past 20 years has been strongly influenced by the changing epidemiology and associated health needs of northern Inuit and Indian people. His publications reflect diverse interests ranging from pharmacology to physiology and metabolism.

Jean Steckle

Jean Steckle is the Nutrition Consultant of Medical Services Branch, Health and Welfare Canada. She was employed in 1976 to promote the development of nutrition programs in community health. Consultation with Indian and Inuit people and organizations lead to the negotiation of guidelines to expand nutrition education and community development programs in the Indian and Northern Health Service.

Dr. Steckle is a graduate of the University of Guelph B.H.Sc. 1952, Cornell University M.Sc. 1956 and the University of Reading, England Ph.D. 1975. She served as a Community Nutrition Expert with FAO in West Africa and at FAO Headquarters in Rome from 1958 to 1971. She took up the post of Associate Director, Foods and Nutrition, with the International Development Research Centre based in Ottawa and later in Dakar, Senegal 1971-1976.

Research and the practical application of results to the development of food and nutrition systems and networks promoting better nutrition through locally available food stuffs continues to be a professional commitment of Jean Steckle through her work with the Indian and Northern Health Services.

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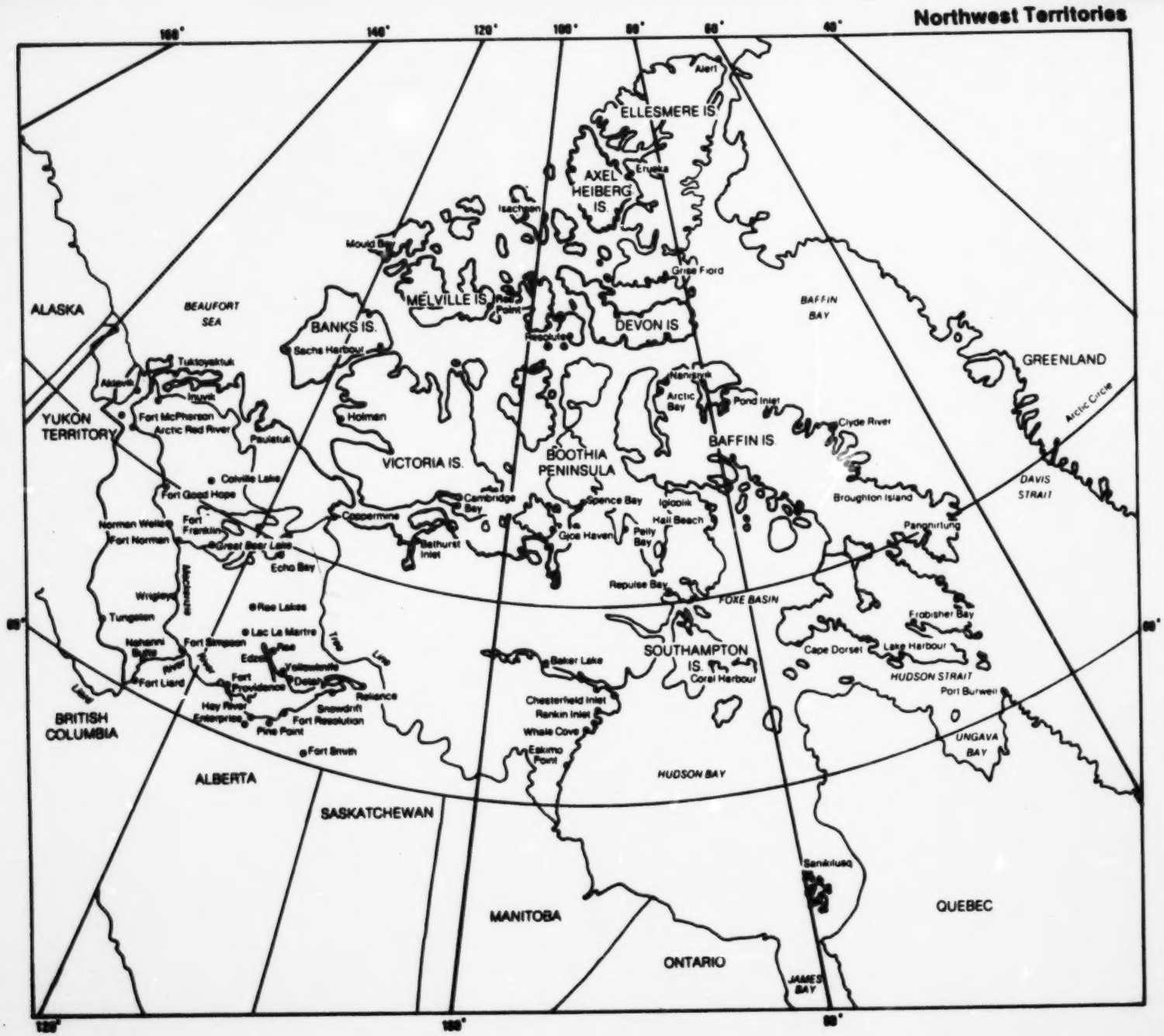
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